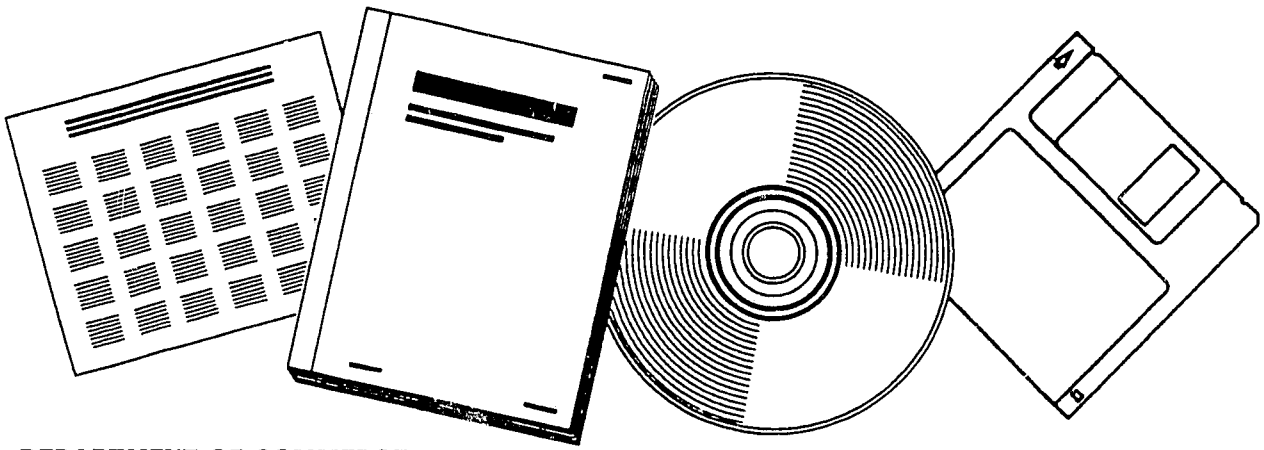
PB96-186275

NASA INFORMATION RESOURCES MANAGEMENT LONG RANGE PLAN, FY 1994-1998

(U.S.) NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
WASHINGTON, DC

JUL 93



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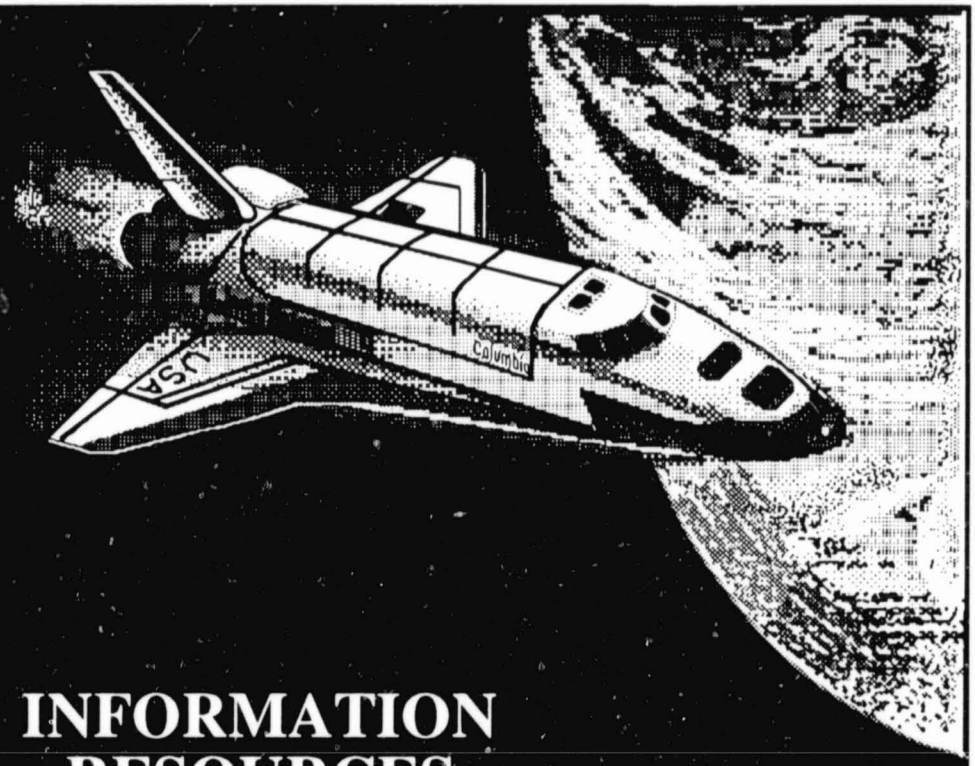
Abstract: Table of Contents: Introduction; Agency 5-Year IRM Investment Projections; Program Specific IRM Activities by Program Office; Major IRM Program Accomplishments for FY 1992; Information Collection Budget; Summary of Computer Security Plans; and Appendix: Acronym List.



INFORMATION RESOURCES MANAGEMENT

LONG RANGE PLAN FY 1994 - 1998

JULY 1993

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

PREFACE

The National Aeronautics and Space Administration (NASA) is continuing its efforts to improve the Information Resources planning process. An activity to review the IRM strategic planning process resulted in the establishment of three process action teams (IRM Definitions, IRM Inventories, and Information Technology Systems Planning). These teams will identify problem areas and recommend needed improvements.

At the same time, NASA's agencywide strategic goals are being revised and the agency is undergoing extensive organizational change. The IRM organization is assessing the impact of these changes on the IRM Program and will be revising IRM plans, goals, and objectives accordingly. This year's IRM long range plans are based on the latest available strategy statements and budget projections.

Information regarding this plan may be obtained by contacting:

Information Resources Management Division
NASA Headquarters, Code JT
Washington, D.C. 20546

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LIST OF EXHIBITS

1. INTRODUCTION

The Information Resources Management (IRM) Long Range Plan reports the IRM plans of the National Aeronautics and Space Administration (NASA) for FY 1994 through FY 1998. This section of the Plan describes the overall NASA IRM program and strategic direction.

1.1. NASA IRM ORGANIZATION AND STRUCTURE

This section describes how NASA manages its IRM structure, including oversight and policy management responsibilities.

1.1.1 IRM Oversight

Oversight of NASA's IRM program is organized in a 3-tiered structure to best support the agency's overall mission and broad spectrum of research and development programs. Exhibit 1-1 provides a graphic representation of this structure.

At level 1 is the Agency's Designated Senior Official (DSO) for IRM, the Associate Administrator for Management Systems and Facilities. Level 2 includes Senior Program IRM Officials (SPIOs) representing the Program Offices. And, level 3 includes Senior Installation IRM Officials (SIIOs) for the Field Installations and NASA Headquarters.

The DSO is responsible for agencywide oversight of IRM activities. SPIOs are responsible for oversight of IRM activities within their Headquarters organization. SPIOs with institutional management responsibilities are also responsible for oversight of IRM activities within their respective installations. SIIOs are responsible for oversight of IRM activities within their respective installations.

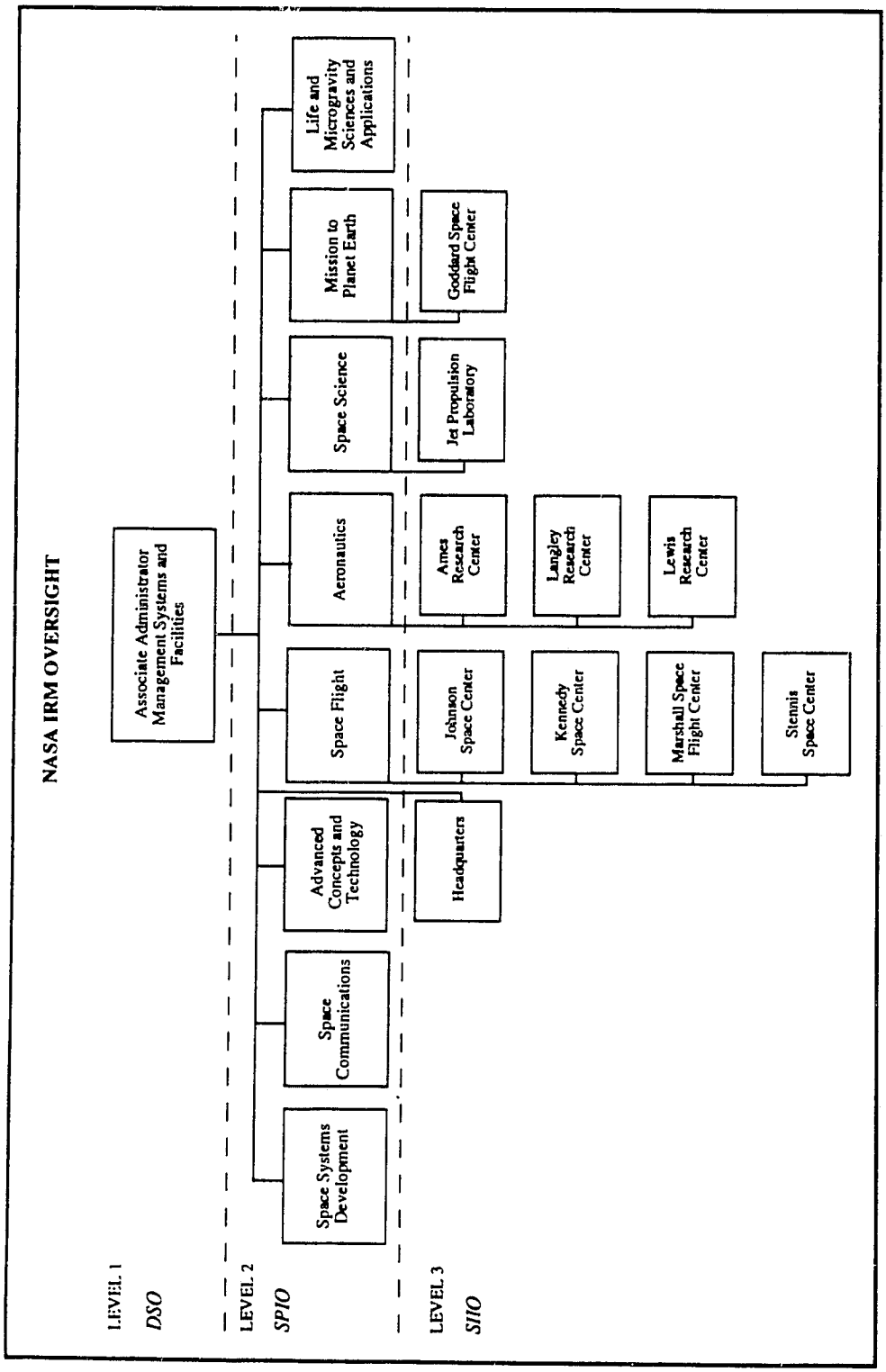

Exhibit 1-1. NASA IRM Oversight.

1.1.2 IRM Policy Management

Responsibilities for agencywide IRM policy and functional management for IRM are shared by the DSO and other Headquarters offices. The organizations responsible for establishment of agencywide policies, standards, and guidelines, as well as coordination, overview, and guidance of agencywide IRM activities are described below.

Office of Management Systems and Facilities: The DSO has assigned responsibility for functional management of specific IRM areas to two Divisions and one Office within the Office of Management Systems and Facilities: the Information Resources Management Division; the Security, Logistics and Industrial Relations Division; and the Resources and Management Controls Office.

The Director of the Information Resources Management Division is responsible for the following IRM areas:

- IRM Planning and Evaluation
- IRM Policy
- Forms Management
- Records Management
- Reports Management and Information Collection Budget
- Information Technology Standards
- Delegations of Procurement Authority for Information Technology Acquisitions
- Printing Management
- Library Management
- Privacy Act Compliance Oversight
- Mail Management
- Correspondence Management.

The Director of the Security, Logistics and Industrial Relations Division is responsible for Automated Information Security (AIS).

The Resources and Management Controls Office is responsible for NASA directives and internal management control. This Office also acts as the NASA liaison to the General Accounting Office and the Office of the Inspector General.

Office of the Chief Financial Officer/Comptroller: The Chief Financial Officer develops and maintains integrated accounting and financial information systems and associated internal controls.

Office of Safety and Mission Assurance: The Associate Administrator for Safety and Mission Assurance develops policies, standards, and guidelines related to software management, quality assurance, and engineering.

Office of Advanced Concepts and Technology: The Assistant Administrator for Advanced Concepts and Technology develops policies and guidelines related to disseminating information that concerns new NASA-developed technologies to external organizations, including the non-aerospace community

Office of Space Communications: The Associate Administrator for Space Communications develops policies, standards, and guidelines related to general telecommunications.

Office of Public Affairs: The Associate Administrator for Public Affairs develops policies, standards, and guidelines related to public information audiovisual products and ensures compliance with the Freedom of Information Act.

Office of Human Resources and Education: The Associate Administrator for Human Resources and Education develops policies, standards, and guidelines related to educational information products developed by NASA.

Office of Procurement: The Assistant Administrator for Procurement develops policies, procedures, and regulations related to the procurement of Federal Information Processing (FIP) resources under Delegations of Procurement Authority received from the General Services Administration through the DSO and oversees reviews, and conducts FIP resource procurements after redelegation to the appropriate NASA procurement organization.

Delegated IRM responsibilities are summarized in Exhibit 1-2.

NASA OFFICE	DELEGATED RESPONSIBILITIES
IRM Division	FIRMR implementation, Delegation of Procurement Authority management, IRM planning and policy, privacy of records, records management, information dissemination, and IRM Review and Evaluation Program implementation (includes scheduling reviews, preparing reports for NASA management and external organizations on findings of IRM reviews, and maintaining records of completed reviews).
Security, Logistics and Industrial Relations Division	Automated Information Security (AIS).
Resources and Management Controls Office	NASA directives and Federal regulations, NASA internal management control, General Accounting Office and Office of the Inspector General liaison.
Office of Procurement	Conduct of FIP resource procurements.
Office of the Chief Financial Officer/ Comptroller	Financial systems and associated internal controls.
Office of Space Communications	General telecommunications.
Office of Safety and Mission Assurance	Software management, quality assurance, and engineering.
Office of Advanced Concepts and Technology	Information dissemination (from the STI database and other sources) concerning new technologies developed by NASA to the non-aerospace community.
Office of Public Affairs	Public information audiovisual products, compliance with the Freedom of Information Act.
Office of Human Resources and Education	Educational information products developed by NASA.
Program Offices	Missions and programs.

Exhibit 1-2. NASA IRM Policy Management Organizations.

1.2. NASA IRM STRATEGY

Information related expenditures represent a significant portion of NASA's budget. Planned expenditures for information resources activities in FY 1994 are over $2.1 billion. Effective and efficient management of information resources is critical to the successful accomplishment of NASA's missions and goals. This section describes strategic plans for both NASA and its IRM activities.

NASA's agencywide and IRM Strategic Plans are currently being revised to incorporate new agency strategies. NASA has recently adopted new strategic goals and is undergoing extensive organizational changes. The IRM Division is assessing the impact of these changes on NASA's IRM program and revising IRM plans, goals, and objectives accordingly. The revised IRM Strategic Plan is expected to be completed by the end of this fiscal year. Therefore, this year's IRM long range plans are based on the latest available strategic information, i.e., draft revisions to the IRM Strategic Plan.

1.2.1 NASA Strategic Plan

NASA's strategic vision has recently been refocused to provide more tangible benefits to America. The new vision says "we boldly expand frontiers in air and space to:

- Provide inspiration and hope for the future,
- Expand human knowledge and experience,
- Contribute to world peace,
- Enhance economic growth and competitiveness,
- Understand and help preserve our environment,
- Support broad national social goals, and
- Maintain high-tech industrial base."

NASA's strategic purpose has been realigned with the new vision. NASA's purpose is to:

- Explore space toward expanding human presence beyond our planet;
- Advance scientific knowledge of the Earth, the solar system, and the universe; and
- Research, develop, and transfer advanced aeronautics, space, and related technologies.

In fulfilling this purpose, NASA contributes to America's goals in economic growth, environmental preservation, educational excellence, and peaceful exploration and discovery.

NASA has identified four primary missions to attain the strategic vision and fulfill the strategic purpose:

- **Mission for Space Development** - learn how humans and machines can sustain operations in space, emphasize large-scale commercial development;

- **Mission for Scientific Research** - develop and transfer relevant technology, target robotic surveys of the universe and our solar system;

- **Mission for Planet Earth** - develop and transfer relevant technology, establish a basis for major policy decisions through a comprehensive study of our environment; and

- **Mission for Aeronautics and Space Industry** - exploit U.S. preeminence in key aeronautics and space industries, exploit U.S. leadership in relevant technologies.

Information, technology, and Information Resources Management play a vital role to help NASA follow these strategic directions and achieve this vision.

1.2.2 NASA IRM Strategic Plan

NASA's IRM goals and objectives continue to be focused on strategic enabling capabilities. These goals and objectives remain responsive to legislative and regulatory requirements. Six IRM strategic goals support successful accomplishment of NASA's missions and goals.

- Develop information resources plans and budgets that are aligned with (a) the Agency's goals and objectives and (b) program plans and budgets.

- Manage information as a valuable Agency resource.

- Adopt NASA-wide standards and procedures, which will encourage [illegible]bility, interoperability, increased connectivity, and security within NASA.

- Assure the continued capability of the workforce to manage and employ information and information technologies in support of NASA's programmatic and institutional missions.

- Improve the information technology acquisition process.

- Advance the application of software engineering practices within NASA.

1.3. ORGANIZATION OF THIS PLAN

The remainder of this plan is organized into six sections.

Section 2, AGENCY 5-YEAR IRM INVESTMENT PROJECTIONS, presents NASA's projected investment in IRM as reported by Program Offices and IRM staff offices.

Section 3, PROGRAM SPECIFIC IRM ACTIVITIES BY PROGRAM OFFICE, demonstrates the integration of strategic planning with the 5-year information technology planning process and provides missions and goals consistent with overall Agency plans, 5-year investment projections, and major Information Technology (IT) initiatives for each NASA Program Office.

Section 4, MAJOR IRM PROGRAM ACCOMPLISHMENTS FOR FY 1992, discusses the major IRM accomplishments of Program Offices and IRM Staff Offices during FY 1992.

Section 5, INFORMATION COLLECTION BUDGET, describes NASA's program to collect information from the public (e.g., reporting, recordkeeping, regulatory monitoring where information is collected) as part of its overall IRM program. This information is provided in response to the requirements of the Office of Management and Budget (OMB) Bulletin 93-12, Appendix C.

Section 6, SUMMARY OF COMPUTER SECURITY PLANS, provides a brief overview of NASA security plans, in response to the requirements of OMB Bulletin 93-12, Appendix E.

Section 7, APPENDIX, provides an acronym list.

2. AGENCY 5-YEAR IRM INVESTMENT PROJECTIONS

NASA IRM 5-year investment projections are presented in Exhibits 2-1 and 2-2. The total amount displayed is the sum of the planned investments for the agency reported in its FY94 budget request. Planned investments reported by the Program Offices and the IRM staff offices are reported where available. Because of recent reorganizations, some offices could not provide projections. Planned investments are presented in $K (thousand dollars).

	FY94	FY95	FY96	FY97	FY98
Space Systems Development	---	---	---	---	---
Space Flight	$657,800	$663,400	$684,700	$703,200	$723,800
Space Communications	303,300	323,400	320,300	327,900	325,200
Aeronautics	270,700	296,500	292,100	301,200	322,600
Advanced Concepts and Technology	36,100	36,100	37,900	38,800	39,300
Space Science	78,300	80,700	66,000	58,500	58,500
Mission to Planet Earth	198,700	239,200	261,700	284,700	273,200
Life and Microgravity Sciences and Applications	---	---	---	---	---
Headquarters Institution	121,400	129,300	96,600	111,200	95,500
Safety and Mission Assurance	6,500	7,100	7,500	7,500	7,100
TOTAL	$2,128,300	$2,241,600	$2,212,400	$2,243,600	$2,254,100

Exhibit 2-1. 5-Year IRM Investment Projections.

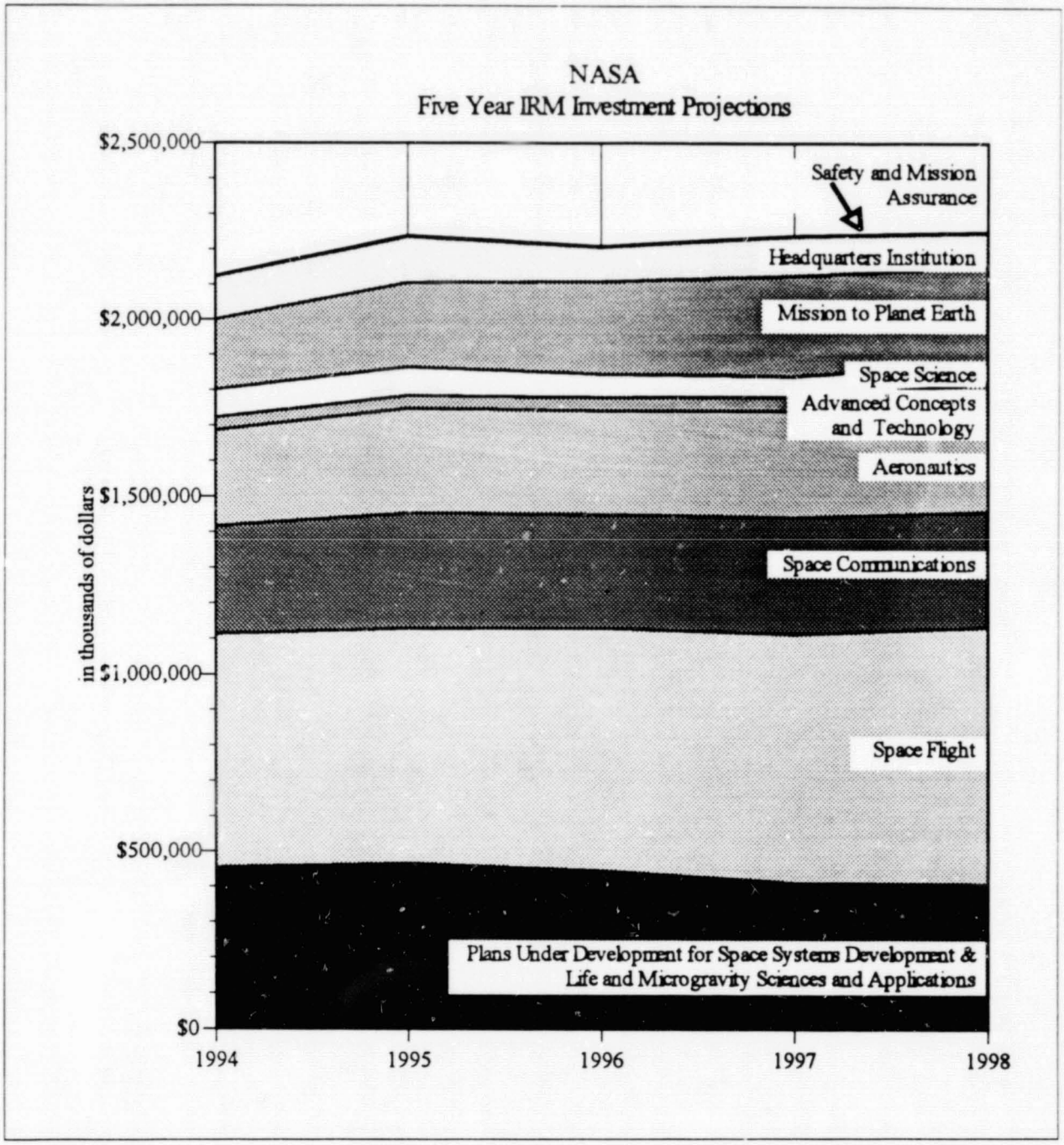

Exhibit 2-2. 5-Year IRM Investment Projections.

3. PROGRAM SPECIFIC IRM ACTIVITIES BY PROGRAM OFFICE

This section demonstrates the integration of strategic planning with the 5-year information technology (IT) planning process and provides missions and goals consistent with overall Agency plans, 5-year IT investment projections, and major IT initiatives for each major NASA Program Office with IRM expenditures.

3.1. OFFICE OF SPACE FLIGHT

The Office of Space Flight (OSF) provides safe, assured, and economic transportation to and from space for people and cargo; operates habitable space facilities to enhance scientific knowledge, support research and development, and enable commercial activity; and ensures a national infrastructure sufficient to advance the presence of humans in space. The OSF consists of an executive headquarters office in Washington, D.C., and four field centers: the Lyndon B. Johnson Space Center (JSC), the John F. Kennedy Space Center (KSC), the George C. Marshall Space Flight Center (MSFC), and the John C. Stennis Space Center (SSC).

3.1.1 Mission/Goals Description

The OSF has established the following strategic goals to:

- Provide reliable and cost-effective access to space;
- Maintain and enhance capabilities and operations to allow humans to live and work continuously in space;
- Provide effective and efficient enabling and support capabilities; and
- Contribute to the national community.

To meet these strategic goals, OSF conducts three activities:

- Operating and maintaining the Space Shuttle and Space Lab;
- Planning for operation of a manned Space Station; and
- Managing institutional capabilities to enable space program activities at JSC, MSFC, KSC, and SSC.

Information technology is integral to the operation of OSF institutions and programs. Specific objectives for OSF that affect the planning and acquisition of information resources are to:

- **Consolidate comparable Space Shuttle and Space Station operations** -- The OSF will consolidate operations of hardware and software systems;

- **Provide an integrated IRM infrastructure** -- Technical advances have greatly improved the ability to access and process information. The OSF challenge is to provide a universally accessible IT and management infrastructure;

- **Provide an integrated IRM program** -- The OSF will implement a fully integrated IRM program across the four OSF Centers. This program will include policies and processes for managing information and IT in a cost-effective manner and will be consistent with the NASA IRM Strategic Plan, ensuring that (1) standards are developed to assure interoperability, (2) a capital investment program with an annual budget are developed, and (3) and OSF supercomputing strategy is implemented; and

- **Improve key activities and research environments (ground and space)** -- Use of state-of-the-art automation and robotics technology in ground operations processing will be optimized.

3.1.2 Five Year IT Investment Projections

The OSF's projected total IT investments for the next five years are presented below and in Exhibit 3-1. Investments are presented in $K (thousand dollars).

FY94	FY95	FY96	FY97	FY98
657,800	663,400	684,700	703,200	723,800

Space Shuttle

FY94	FY95	FY96	FY97	FY98
464,900	465,500	483,200	496,700	512,900

The primary program objective of the Space Shuttle is to continue supporting NASA launch requirements while maintaining the program focus on safety and mission success demonstrated since returning the Shuttle to flight. The Shuttle is a key element of America's space program because of it's unique capabilities. The Shuttle is the first reusable space vehicle and is configured to carry many different types of space apparatus, spacecraft, and scientific experiments. In addition to transporting materials, equipment, and spacecraft to orbit, the Shuttle offers unique capabilities such as retrieving payloads from orbit for reuse, servicing and repairing satellites in space, safely transporting humans to and from space, and operating and returning space laboratories.

The Shuttle program strategic thrust is to maintain the capability to fly eight flights per year. In addition, the program is currently implementing modifications that will improve the safety margins of the Shuttle by a factor of two, as well as providing performance and capability enhancements such as a 30-day Extended Duration Orbiter capability. However, the program is acutely aware that providing reliable access to space must be cost-effective if we expect to exploit our capability. As a result, major cost reductions have been implemented since the FY92 Congressional budget.

The Information Technology initiatives planned to support the Space Shuttle include:

- Reconfiguring the Mission Control Center to use networked workstations;
- Upgrading the Shuttle Mission Simulator to replace the network simulator, rehost the Spacelab and payload processors, and integrate with Space Station;
- Upgrading the Systems Engineering Simulator to support the glass-cockpit, Remote Manipulator System, and multiple payloads;
- Developing an improved system for vehicle and program configuration management;
- Upgrading various networks and personal workstations throughout all four Centers;
- Completing the Shuttle Drawing System at JSC, KSC, and MSFC; and
- Acquiring the Shuttle payload thermal analysis system.

Space Station Utilization/Space Lab

FY94	FY95	FY96	FY97	FY98
19,300	20,300	17,700	17,100	16,900

SPACEHAB-1 was the initial flight of a commercially developed Shuttle cargo-bay module for man tended, middeck-class and rack mounted experiments. NASA's Office of Commercial Programs determined that their requirements for middeck-class experiments exceeded NASA's capability within the Shuttle middeck. Commercial Program flight requirements are to support private sector research initiatives primarily sponsored by the Center for the Commercial Development of Space. The current SPACEHAB contract is to provide integration support and an augmentation module on which NASA has leased 200 lockers to be used throughout six SPACEHAB Research Laboratory flights.

Institution

FY94	FY95	FY96	FY97	FY98
173,600	177,600	183,700	189,400	194,000

IT initiatives include the local administrative and operational programs required to support each of the four Space Flight Center's institutional systems, such as business systems, general office automation, and other FIP resources to support overall Center operations.

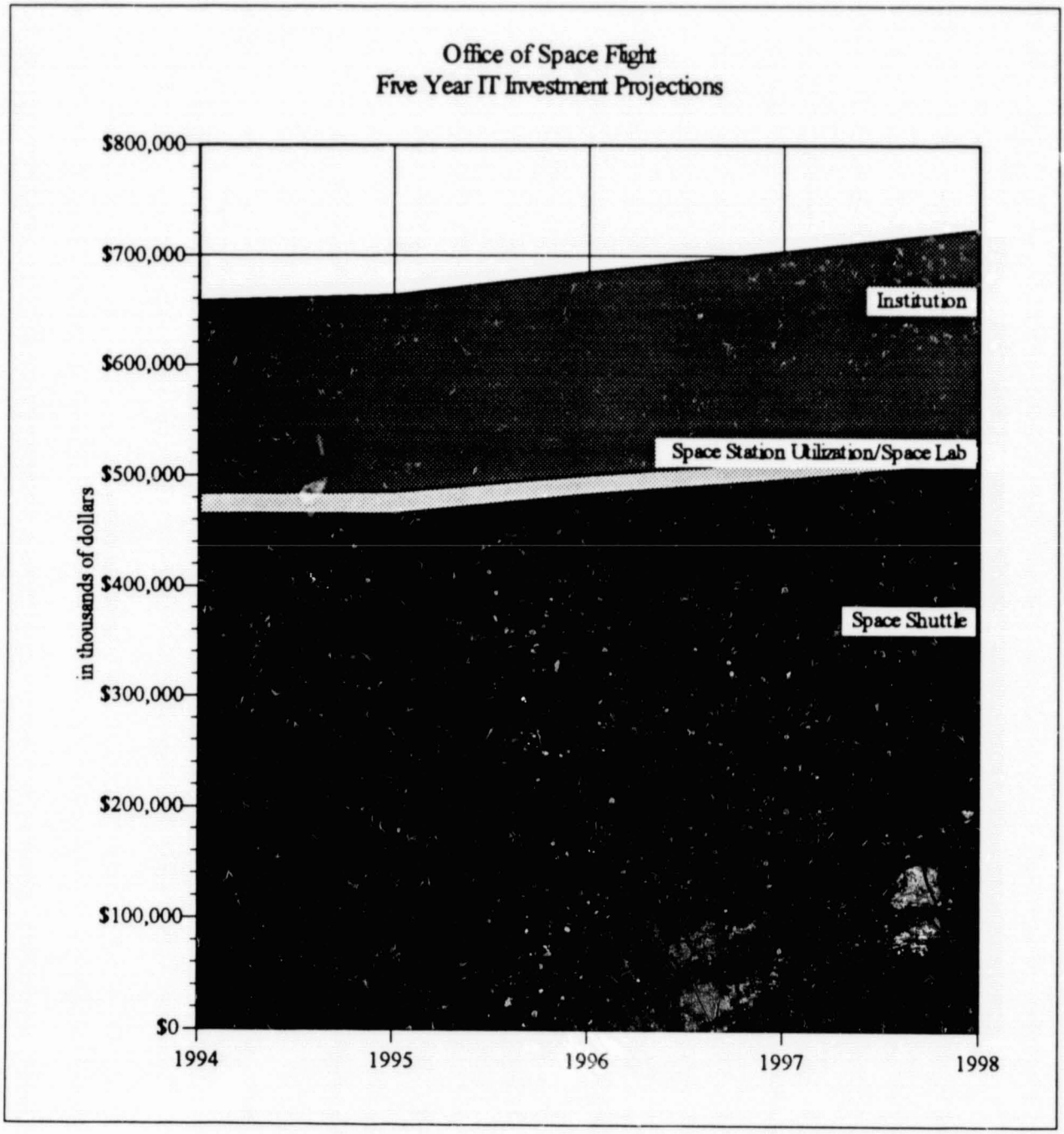

Exhibit 3-1. OSF Total IT Investments by Program.

3.1.3 Major IT Initiatives/Procurement

49 major OSF IT initiatives are described in this section and summarized in Exhibit 3-2. These initiatives are grouped by field installation. A major IT initiative/procurement project is an undertaking for which the cost of system development and acquisition from concept definition through implementation will exceed $25 million, or the cost in any one year will exceed $10 million. The following major initiatives are funded primarily by OSF; however, the total figures presented may include funding from other Program Offices. Planned investments are presented in $K (thousand dollars).

Johnson Space Center

Mission Control Center

FY94	FY95	FY96	FY97	FY98
76,000	77,600	87,900	80,900	83,900

The Mission Control Center (MCC) contains the Shuttle Data Processing Complex, the Near Real Time System, the Telemetry Processing Computers, the Payload Data Distribution Center, Meteorological Interactive Data Display System, and various other computer systems that run software applications in support of Shuttle flights. The Flight Planning System is the replacement system for the Crew Activity Planning System.

Software Development Facility

FY94	FY95	FY96	FY97	FY98
40,600	41,100	44,900	46,800	49,400

The Software Development Facility (SDF) supports development, verification, and maintenance of the Primary Avionics System Software, the Backup Flight Software, and the HAL/S compiler. The SDF equipment includes an Amdahl 5890-600E, Flight Equipment Interface Devices, printers, storage, microfiche printers, tape drives, and work stations. Operational support, sustaining engineering and software maintenance for the SDF is provided under the Mission Operations Support Contract (MOSC). Hardware maintenance of the Amdahl is provided by the Flight Data Systems Division. Remaining equipment maintenance is provided by MOSC.

Shuttle Mission Simulator

FY94	FY95	FY96	FY97	FY98
40,300	39,700	36,700	42,300	47,100

The Mission Operations Directorate Training Division is responsible for providing flight simulation training in the Shuttle Mission Simulator for the astronauts before each Shuttle flight. In addition, the Shuttle Mission Simulator, in conjunction with the Mission Control Center, is responsible for providing integrated flight crew and flight controller training. The Shuttle Mission Simulator complex provides full mission simulators, network systems simulations, and payload simulators for the purpose of flight crew and flight controller training, flight procedures development, and spacecraft design verification support.

Mission Operations Directorate Consolidated Support

FY94	FY95	FY96	FY97	FY98
34,300	35,800	40,000	46,200	47,600

Mission Operations Directorate (MOD) Consolidated Support provides support in the following areas: Tools for Resource Analysis and Management (TRAM) and Facility Integration and Documentation System (FIDS). TRAM provides an integrated set of models for both production and analysis of orbiter resource requirements (consumables) in the flight design process. FIDS consists of Integrated Logistics Support (ILS) and the OMNIPLAN Documentation Support. ILS is responsible for procurement of spares and repairs required to support MOD facilities. OMNIPLAN Documentation Support provides MOD documentation production support.

Integrated Management Information Center

FY94	FY95	FY96	FY97	FY98
23,600	23,700	22,500	23,500	20,700

The Integrated Management Information Center (IMIC) consists of all computers, networks, workstations, and services that the Space Shuttle Program Office uses to perform its duties. Equipment and services are located at JSC, MSFC, KSC, as well as at a number of other NASA and contractor facilities. It should not be confused with the Integrated Management Information Computer which is a part of the Information Center.

Center Information System

FY94	FY95	FY96	FY97	FY98
23,100	24,400	26,500	27,600	28,600

The Center Information System (CIS) provides general word processing, electronic mail services, data base management systems, fourth-generation languages, and management decision capability for most JSC organizations. The system consists of an Amdahl 5890-300 and an Amdahl 5995-700A.

Shuttle Avionics Integration Lab

FY94	FY95	FY96	FY97	FY98
17,400	17,900	18,300	19,300	20,300

The Shuttle Avionics Integration Laboratory (SAIL) is a central facility composed of two test stations that fully integrate the avionics and related hardware (or simulations of hardware), flight software, flight procedures, and associated ground support hardware and software for verification testing. The major activities of the SAIL operation include verifying avionics interfaces (including those between payloads and the orbiter), integrated functional and avionics mission capability of the orbiter, and the mated elements (including the external tank, solid rocket booster, Space Shuttle main engine, and the launch processing system).

Backup Flight Software

FY94	FY95	FY96	FY97	FY98
16,600	16,200	16,600	17,100	17,400

Provides software development, maintenance, test and checkout, integration, and configuration control of the National Space Transportation System Backup Flight Software. FIP projections include only support services and do not contain hardware requirements.

Software Production Facility

FY94	FY95	FY96	FY97	FY98
13,200	12,700	12,900	13,200	13,700

The Software Production Facility (SPF) provides support for Shuttle unique flight software reconfiguration products utilized by the orbiter (mass memory loads), Mission Control Center, Shuttle Mission Simulator, and KSC. The SPF is available for shuttle mission activities that include troubleshooting in-flight software anomalies.

Flight Design Computation Facility

FY94	FY95	FY96	FY97	FY98
11,600	11,600	11,700	12,200	12,700

To support Shuttle flights, the Flight Design Computational Facility (FDCF) provides the analysis of payload flight design requirements and the generation of operational flight profile data. The FDCF does launch and payload opportunity planning as well as on-board/descent flight design. It also provides real-time support for missions and simulations via processing Day of Launch and Day of Landing winds data. FDCF has added the Robotics Planning Facility to support numerically-intensive analysis, modeling, mission planning, simulation and three dimensional presentation of shuttle and advanced robotics operations.

Engineering Computation Facility

FY94	FY95	FY96	FY97	FY98
12,000	9,500	9,500	9,700	9,900

The Engineering Computational Facility (ECF) consists of a Cray X-MP EA/464 high speed vector processor and an Amdahl 5990-500 scalar processor, operating under the UNIX environment. These institutional computer systems are primarily used to provide computational support for engineering analyses and scientific investigations by the Engineering and the Space & Life Sciences Directorates. The Amdahl is a virtual memory machine with two Central Processing Units (CPUs), 128 million words (MWords) of memory, and approximately 70 gigabytes of mass storage available on-line direct access storage devices (DASD). The Cray is a real memory machine with four CPUs, 64 MWords of memory, and approximately 84 gigabytes of DASD.

Customer Support

FY94	FY95	FY96	FY97	FY98
9,200	9,300	9,700	10,000	10,300

This system provides Automatic Data Processing-related services and materials to the JSC user community, including on-site contractors and limited functions for off-site contractors. Services include procurement of workstations, network and data systems FIP resources, as well as installation, maintenance, and support (e.g. Help Desk, training, Information Systems Directorate Products Center, consultation) for these resources. All hardware handled by this system belongs to other JSC systems.

Center Information Network

FY94	FY95	FY96	FY97	FY98
6,900	8,400	10,200	10,800	11,200

The Center Information Network (CIN) is based on an IBM systems network architecture and supports Shuttle, Space Station, and institutional requirements. It is part of a larger network called NASANET, which has nodes at the NASA centers, the European Space Agency, and the space agency in Japan.

Flight Training and Planning Facility

FY94	FY95	FY96	FY97	FY98
4,700	4,900	5,000	5,000	5,300

The flight training portion of Flight Training and Planning Facility (FTPF) includes 3 Single System Trainers, a Flight Controller Trainer, and a Crew Software Trainer. These elements are supported by software development facilities and the Training Information Management System. The flight planning portion of FTPF includes the Flight Planning System (FPS) and the Control Document Production Area (CDPA). FPS provides automated production of the Shuttle Flight Plans and composes a distributed, DEC/VMS-based, networked Level II processing system. CDPA is a Xerox-based system that provides production of Flight Data File documents and support for the Portable Onboard Computer.

Mission Operations Directorate Office Automation

FY94	FY95	FY96	FY97	FY98
8,500	8,700	11,200	11,600	12,700

The MOD manages operations development and manned space flight program support. MOD office automation provides operations personnel with support systems required to accomplish their tasks in the most cost effective manner.

Central Telecommunications System

FY94	FY95	FY96	FY97	FY98
4,100	4,300	4,400	4,600	4,800

The Central Telecommunications System (CTS) provides institutional telecommunications support and switched data communications support to the Center. CTS consists of 14-node ROLM CBX II 9000AEs at JSC, a single node CBX II 9000 at Ellington Field, and CBX 9751s in the Clear Lake City off-site facilities. These three systems are linked via tie lines. The VAX 11/750 runs

the Telecommunications Control Center software, which serves as the management system for CTS.

JSC Information Network

FY94	FY95	FY96	FY97	FY98
3,800	4,100	3,800	4,000	4,200

The JSC Information Network (JIN) is an integrated network, operating under a controlled multi-vendor communications environment. Various network architectures have been, and will continue to be, integrated and consolidated to achieve an acceptable interoperability level using standard network topologies.

Information Systems Directorate Customer Support

FY94	FY95	FY96	FY97	FY98
4,800	4,800	5,200	5,400	5,600

Provides customer support for the Engineering Directorate.

Administrative Systems

FY94	FY95	FY96	FY97	FY98
2,800	2,600	4,000	4,200	4,300

Administrative Systems provides maintenance of financial applications and support to the development of uniform systems. In addition, this system provides maintenance of Center Operations directorate systems (e.g., NASA Equipment Management System, NASA Institution Environment Management System, Interactive Supply Management System, Security Management System) The system also provides production support to track reports and microfiche; pick-up, deliver and assemble reports; install new systems and programs; test system/program integration; and resolve production problems. All Civil Service Automated Data Processing (ADP) hardware and software is acquired from the Research and Program Management pool.

Crew and Thermal Engineering Systems

FY94	FY95	FY96	FY97	FY98
3,800	4,000	4,200	4,400	4,500

This system supports the ADP requirements of the Crew and Thermal Systems Division (CTSD) (EC) and provides office automation, Computer-Aided Design (CAD) and database support services to the Automation and Robotics Division. CTSD is responsible for various functions

related to Shuttle and Space Station thermal control systems, extra-vehicular activity systems, and environmental control and life support systems for crew personnel. ADP is used for data acquisition, data reduction, analysis, control, office automation, database applications and CAD. It is primarily a collection of DEC VAX hosts and workstations connected to the EC LAN.

Software Technology Lab

FY94	FY95	FY96	FY97	FY98
4,600	4,800	4,800	3,500	3,500

The Software Technology Lab facility includes a variety of mini- and micro-computers devoted to artificial intelligence, graphics, robotics, automated software development, workstation prototyping, operations planning systems, and engineering analysis disciplines.

Structures and Mechanics Engineering System

FY94	FY95	FY96	FY97	FY98
3,800	4,000	3,600	3,200	3,300

The Structures and Mechanics Division is responsible for the design, analysis, verification, and technical management of structural, thermal, and mechanical aspects of space systems. Computer hardware includes personal computers for all users, general purpose workstations, and a VAX 8650, all connected through ethernet. In addition to general purpose software for functions such as office automation, databases, and communications, specialized computational tools are required to support the engineering design, analysis, and verification tasks.

Man-Systems Laboratories

FY94	FY95	FY96	FY97	FY98
4,300	4,400	4,300	3,800	4,500

The Man-Systems Laboratories provide FIP resource systems supporting lap-top computers for on-orbit use, mockups and trainers; engineering and scientific analyses in the areas of Computer-Aided Design, human factors, space flight food management, anthropometrics, biomechanics, space flight hygiene and housekeeping; and space flight imaging systems.

Safety, Reliability, and Quality Assurance IRM

FY94	FY95	FY96	FY97	FY98
3,500	3,800	4,100	4,300	4,500

The Safety, Reliability, and Quality Assurance (SR&QA) IRM activity provides the contractor support staff responsible for planning, integrating, implementing, and administering user assistance with FIP resources. Support is also provided for defining the standards, policies, and procedures on FIP resources acquisitions, system development life cycle, configuration management, and the integration of manually and electronically stored data and SR&QA business processes.

Space Station Control Center

FY94	FY95	FY96	FY97	FY98
94,200	94,900	91,300	84,100	85,300

The Space Station Control Center provides centralized control for the Space Station Freedom Program. This includes the reception, transmission, recording, and processing of large volumes of telemetry, command, trajectory, video, weather, and audio data. The Operations Support Contractor is responsible for installation, maintenance and operation of Space Station Control Center systems. Installation of Mission Support contractor-provided equipment occurs from FY92 through FY98.

Systems Engineering Division

FY94	FY95	FY96	FY97	FY98
3,500	6,000	4,500	4,400	4,000

The Systems Engineering Division (SED) supports the development of integrated system requirements, design concepts, mission profiles, and flight envelopes necessary for system design to meet program objectives. SED maintains a simulation laboratory that provides a dynamics simulator consisting of digital computers, custom interfaces, and special purpose computing equipment. This simulator supports the development of advanced aerospace systems and the testing and integration of the avionics systems of aerospace vehicles.

Space Station Training Facility

FY94	FY95	FY96	FY97	FY98
74,200	76,900	61,800	70,800	71,700

The Mission Operations Directorate provides flight simulation training for the Space Station Freedom astronauts. In addition, the Space Station Training Facility, in conjunction with the Space Station Control Center, provides integrated flight crew and flight controller training. The major near-term activities are development and operation of management information, training, mission planning and design, and mission control capabilities.

Space Station Ground Software Production Facility

FY94	FY95	FY96	FY97	FY98
6,200	3,900	2,000	1,900	1,700

The Ground Systems Development Environment has been designated an official Software Production Facility that utilizes Space Station's Software Support Environment tools for the development of ground systems software. The ground systems development workstations are used for requirements definition. Communications are provided to the appropriate contractor facilities to attach development workstations to the Software Production Facility host used for developing software for the Space Station Control Center and Space Station Training Facility.

Data Support Systems

FY94	FY95	FY96	FY97	FY98
3,000	9,500	8,600	8,400	10,000

The JSC Data Support Systems (JSCDSS) support the Space Station Program Office (SSPO), JSC organizations, and contractors participating in the Space Station Freedom Program. The summary application is the Electronic Drawing Library System which allows JSC users to view raster images of Work Package 2 engineering drawings. Other applications include Unigraphics' computer-aided design system, Artemis, and several Oracle engineering and business data base applications used for drawing and materials information, weight and power data, configuration management, and data tracking systems. The JSCDSS also serves as the official delivery point for electronic data delivered by the SSPO prime contractor.

Software Support Environment Development Facility

FY94	FY95	FY96	FY97	FY98
21,500	22,500	22,400	22,400	21,400

The Software Support Environment Development Facility (SSEDF) is the Software Support Environment (SSE) System Element developed and used by the Space Station Freedom Program for the life-cycle management of the SSE. It is composed of Automated Data Processing Equipment (ADPE) hardware and software, local area networks, interfaces to computer network(s), unique hardware, and the SSE.

Central Software Facility/Central Avionics Facility

FY94	FY95	FY96	FY97	FY98
67,600	55,700	36,900	30,500	29,400

The Central Software Facility/Central Avionics Facility provides support to the integration software and avionics verification process.

Kennedy Space Center

Checkout, Control and Monitor System

FY94	FY95	FY96	FY97	FY98
26,600	28,800	30,300	28,000	22,800

The Checkout, Control and Monitor System (CCMS) is dedicated to Shuttle launch support--directly interfacing with the Shuttle and its ground support equipment. Nine CCMS sets perform real-time command/monitor functions for Shuttle testing and launch. Other functions include software development and verification, classified operations, and utility control. There are three research and development projects being developed within CCMS: Remote Maintenance Monitoring System (RMMS), OPERation Analyst (OPERA), and Automated Test Expert Aiding System Environment (AT- EASE). RMMS and OPERA were brought on-line in FY90 to help set the configuration of CCMS, and detect, isolate, and correct CCMS and LRU failures. AT-EASE provides expert information that assists engineering personnel develop automated testing programs used by maintenance technicians to detect, isolate and correct Launch Processing System LRU failures.

Central Data System

FY94	FY95	FY96	FY97	FY98
10,300	10,700	11,500	17,500	23,800

The Central Data Subsystem (CDS) of the Launch Processing System is supported by two dual-processor Bull DPS 90/92T configured in a single set. This set is dedicated to support the checkout and launch of the Shuttle Transportation System through near real-time Special Interfaces to CCMS of the Launch Processing System. The CDS Special Interfaces provide the capability to record near real-time data and simulate ground support equipment to check out and validate software programs used in CCMS.

Administrative Computer System

FY94	FY95	FY96	FY97	FY98
5,400	5,700	5,800	5,900	6,100

Provides computer support for Administrative and mission support functions such as personnel, finance, procurement, inventory control, and work management.

Microcomputing Support

FY94	FY95	FY96	FY97	FY98
4,500	5,000	5,400	5,900	6,100

Provides hardware and software maintenance, training, and technical consulting for the BOC microcomputer users.

Kennedy Inventory Management System

FY94	FY95	FY96	FY97	FY98
4,800	4,500	4,900	5,100	5,300

Provides information to NASA and contractor users on almost one- half million logistics line items in a multi-account, multi-site environment.

Computer Aided Design and Engineering System

FY94	FY95	FY96	FY97	FY98
3,900	3,800	3,900	4,000	4,300

The Computer Aided Design and Engineering System supports the Design Engineering Directorate, KSC Institutional and Shuttle facilities; it also performs data reduction for the Shuttle Program.

Space Station Test, Control and Monitor System

FY94	FY95	FY96	FY97	FY98
29,500	16,600	5,600	1,000	0

Provides real-time command and control of the Space Station elements and payloads, which will be processed at KSC. It supports operations at 12 locations in 3 facilities. Its modular design uses commercial off-the-shelf equipment and existing standards. Its projected life is 30 years.

Payload Data Management System

FY94	FY95	FY96	FY97	FY98
6,300	7,300	5,200	6,400	5,500

The Payload Data Management System is a collection of applications and hardware platforms that support payload information processing. These systems enable Payload Ground Operations Personnel to manage data and process information in selected functional areas.

Marshall Space Flight Center

Mission Services Contract

FY94	FY95	FY96	FY97	FY98
40,700	39,500	39,300	40,100	40,700

The MSFC Computational Mission Services and Program Support Communications contract associated with the Systems Development and Implementation activities.

Mission Services Contract

FY94	FY95	FY96	FY97	FY98
14,800	15,800	16,200	16,800	17,000

The MSFC Computational Mission Services and Program Support Communications contract associated with the Telecommunications Center activities.

Mission Services Contract

FY94	FY95	FY96	FY97	FY98
25,600	35,800	40,100	43,800	56,100

The MSFC Computational Mission Services and Program Support Communications contract associated with the Huntsville Operations Support Center/Payload Crew Training Complex activities.

Engineering Analysis and Data System

FY94	FY95	FY96	FY97	FY98
14,000	14,000	14,000	14,100	14,200

The Engineering Analysis and Data System provides the computational resources required to support complex engineering and scientific compute-intensive applications in such areas as computational fluid dynamics, structural design, stress analysis, thermal analysis, and space science research. The Engineering Analysis and Data System supports center programs such as the Solid Rocket Motor, Advanced Solid Rocket Motor, Space Shuttle Main Engine, Spacelab, Alternate Turbo Pump design, Space Station Freedom, and others.

Slidell Computer Complex

FY94	FY95	FY96	FY97	FY98
8,700	8,300	8,000	7,700	8,000

Through a mission services contract, this complex provides computational resources required to support External Tank manufacturing and Space Shuttle launch data analysis and implements a computer-aided productivity initiative for the External Tank manufacturing effort at Michoud Assembly Facility.

Science and Engineering

FY94	FY95	FY96	FY97	FY98
4,600	7,100	9,500	10,400	11,500

Supports the general Science and Engineering Directorate information resources activity. Includes management and oversight of all science and engineering information processing resources, and specific oversight of the Science and Engineering Director's Office, Office of the Assistant Director for Management, Space Transportation Systems Chief Engineer's Office, Space Systems Chief Engineer's Office, and Research and Technology Office.

Telecommunications Mission Services

FY94	FY95	FY96	FY97	FY98
5,300	5,300	5,600	5,700	6,100

Provides local telecommunications mission services at MSFC, Slidell Computer Complex, and Michoud Assembly Facility. The local services utilize digital Private Automatic Branch Exchange systems, cable plant, local area networks and extensive specialized telecommunications facilities and equipment to meet the MSFC's requirements for a broad range of information systems in support of institutional, program and mission operations functions.

Enhanced Data System

FY94	FY95	FY96	FY97	FY98
12,800	8,800	10,200	1,300	1,000

The Enhanced Data System is a general purpose, distributed processing system for processing and displaying real-time spacecraft telemetry and command data. Supports the Spacelab, Space Shuttle, Advanced X-ray Astrophysics Facility, and Space Station Freedom programs.

Payload Data Services System

FY94	FY95	FY96	FY97	FY98
3,600	11,300	14,600	6,600	0

Receives, processes, and distributes payload telemetry from Space Station Freedom; receives data stream, decodes and de-multiplexes the data to either virtual channel and/or packet levels in real time, and distributes data to the user community; performs level "0" processing on all data and distributes data in non-real time to the user community; supports the Space Station Freedom program.

OSF Headquarters

OSF Management Information System

FY94	FY95	FY96	FY97	FY98
6,100	6,400	6,800	7,100	6,600

Provides management information to OSF and Office of Space Systems Development (Headquarters) personnel; provides administrative and programmatic support.

	FY94	FY95	FY96	FY97	FY98
Mission Control Center	76,000	77,600	87,900	80,900	83,900
Software Development Facility	40,600	41,100	44,900	46,800	49,400
Shuttle Mission Simulator	40,300	39,700	36,700	42,300	47,100
Mission Operations Directorate Consolidated Support	34,300	35,800	40,000	46,200	47,600
Integrated Management Information Center	23,600	23,700	22,500	23,500	20,700
Center Information System	23,100	24,400	26,500	27,600	28,600
Shuttle Avionics Integration Lab	17,400	17,900	18,300	19,300	20,300
Backup Flight Software	16,600	16,200	16,600	17,100	17,400
Software Production Facility	13,200	12,700	12,900	13,200	13,700
Flight Design Computation Facility	11,600	11,600	11,700	12,200	12,700

Exhibit 3-2. List of Major Initiatives for OSF.

	FY94	FY95	FY96	FY97	FY98
Engineering Computation Facility	12,000	9,500	9,500	9,700	9,900
Customer Support	9,200	9,300	9,700	10,000	10,300
Center Information Network	6,900	8,400	10,200	10,800	11,200
Flight Training and Planning Facility	4,700	4,900	5,000	5,100	5,300
Mission Operations Directorate Office Automation	8,500	8,700	11,300	11,600	12,700
Central Telecommunications System	4,100	4,300	4,400	4,600	4,800
JSC Information Network and FMNET	3,800	4,100	3,800	4,000	4,200
Information Systems Directorate Customer Support	4,800	4,800	5,200	5,400	5,600
Administrative Systems	2,800	2,600	4,000	4,200	4,300
Crew and Thermal Engineering Systems	3,800	4,000	4,200	4,400	4,500
Software Technology Lab	4,600	4,800	4,800	3,500	3,500
Structures and Mechanics Engineering System	3,800	4,000	3,600	3,200	3,300

Exhibit 3-2. List of Major Initiatives for OSF (continued).

	FY94	FY95	FY96	FY97	FY98
Man-Systems Laboratories	4,300	4,400	4,300	3,800	4,500
Safety, Reliability and Quality Assurance IRM	3,500	3,800	4,100	4,300	4,500
Space Station Control Center	94,200	94,900	91,300	84,100	85,300
Systems Engineering Division	3,500	6,000	4,500	4,400	4,000
Space Station Training Facility	74,200	76,900	61,800	70,800	71,700
Space Station Ground Software Production Facility	6,200	3,900	2,000	1,900	1,700
Data Support Systems	3,000	9,500	8,600	8,400	10,000
Software Support Environment Development Facility	21,500	22,500	22,400	22,400	21,400
Central Software Facility/Central Avionics Facility	67,600	55,700	36,900	30,500	29,400

Exhibit 3-2. List of Major Initiatives for OSF (continued).

	FY94	FY95	FY96	FY97	FY98
Checkout, Control and Monitor System	26,600	28,800	30,300	28,000	22,800
Central Data System	10,300	10,700	11,500	17,500	23,800
Administrative Computer System	5,400	5,700	5,800	5,900	6,100
Microcomputing Support	4,500	5,000	5,400	5,900	6,100
Kennedy Inventory Management System	4,800	4,500	4,900	5,100	5,300
Computer Aided Design and Engineering System	3,900	3,800	3,900	4,000	4,300
Space Station Test Control and Monitor System	29,500	16,600	5,600	1,000	0
Payload Data Management System	6,300	7,300	5,200	6,400	5,500
Mission Services Contract	40,700	39,500	39,300	40,100	40,700
Mission Services Contract	14,800	15,800	16,200	16,800	17,000
Mission Services Contract	25,600	35,800	40,100	43,800	56,100

Exhibit 3-2. List of Major Initiatives for OSF (continued).

	FY94	FY95	FY96	FY97	FY98
Engineering Analysis and Data System	14,000	14,000	14,000	14,100	14,200
Slidell Computer Complex	8,700	8,300	8,000	7,700	8,000
Science and Engineering	4,600	7,100	9,500	10,400	11,500
Telecommunications Mission Services	5,300	5,300	5,600	5,700	6,100
Enhanced Data System	12,800	8,800	10,200	1,300	1,000
Payload Data Services System	3,600	11,300	14,600	6,600	0
OSF Management Information System	6,100	6,400	6,800	7,100	6,600

Exhibit 3-2. List of Major Initiatives for OSF (continued).

3.2. OFFICE OF SPACE SYSTEMS DEVELOPMENT

The Office of Space Systems Development (OSSD) was created in 1991 in response to recommendations of the Advisory Committee on the Future of the United States Space Program. Major programs of the OSSD include Space Station Freedom, Advanced Launch and Propulsion Systems, the United States Air Force Spacelifter Program, and other advanced systems studies. The Advanced Launch and Propulsion System includes the Advanced Solid Rocket Motor Program and the Space Transportation Main Engine program.

The OSSD has its Headquarters office in Washington, D.C. and primary efforts at four field centers: Space Station Freedom, Reston, VA, Johnson Space Center (JSC), George C. Marshall Space Flight Center (MSFC), and John C. Stennis Space Center (SSC).

3.2.1 Mission/Goals Description

Through technical and managerial excellence, the OSSD provides superior operational space systems to effect the optimum utilization and exploration of space. The operational systems support manned and unmanned launch and flight capabilities to meet National objectives in space.

To make this vision a reality, the OSSD pursues the following five goals:

- Plan, develop, promote, and deliver high quality, safe, efficient, and effective operational space systems to meet customer requirements for transportation and space-based facilities.
- Stimulate advanced technology development and technology transfer within the Government and industry to support the future needs of the nation.
- Maintain and continuously improve technical and managerial excellence.
- Promote international cooperation and support for mutually beneficial programs.
- Effect clear and concise management and control of all OSSD to insure cost effective operations with efficient control to insure proper timely results of design, development, and implementation of technology.

3.2.2 Five Year IT Investment Projections

The OSSD's projected total IT investments for the next five years are not available for this document. IT investment projections are expected to change as programs and projects are defined.

Space Station

Space Station Freedom is the most complex engineering feat attempted by this Nation. It is the largest spacecraft ever considered to be built and is intended to be the greatest international space venture ever undertaken. For the first time, the United States and its international partners--Canada, Japan, and the European Space Agency--will build and operate a large, permanently human tended facility in orbit. Space Station Freedom has proceeded through its Critical Design Review in its present configuration. A Space Station Redesign Team is actively involved in determining alternative design options and associated costs.

Flight Systems

Last year, IT requirements in support of the National Launch System (NLS) were included in the Agency's IRM Long Range Plan. The NLS has now been terminated and only modest funds are included in NASA's FY94 budget request for the continuation of the Space Transportation Main Engine (STME), which was the proposed propulsion system for the NLS.

The President's 1994 budget request contains $54 million for the Air Force's proposed Spacelifter program. It is anticipated that NASA MSFC would receive approximately $20 million of these funds to support the propulsion aspects of Spacelifter concepts, including continued STME activities. Some portion of this would be used for continued upgrade and replacement of older computers and migration of applications to new systems and for network expansion and enhancement of interoperability and data transfer capability between NASA centers. This was estimated previously by the STME project to be 2% of the total project's cost.

There are no IT investment projections for the Advanced Solid Rocket Motor or the Advanced Programs Offices at this time.

3.2.3 Major IT Initiatives/Procurement

One major OSSD IT initiative is described in this section. A major IT initiative/procurement project is an undertaking for which the cost of system development and acquisition from concept definition through implementation will exceed $25 million, or the cost in any one year will exceed $10 million. The following major initiative is funded primarily by OSSD; however, the total figures presented may include funding from other Program Offices. Planned investments are presented in $K (thousand dollars).

Technical and Management Information System

FY94	FY95	FY96	FY97	FY98
36,900	36,800	36,200	41,100	43,100

Provides automated support in the management of technical information associated with the Space Station Freedom program; includes applications supporting the tracking of review item discrepancies, requirements management and the program automated library, program functional models and data dictionary, the engineering database, and engineering drawing library supporting Space Station.

3.3. OFFICE OF SPACE COMMUNICATIONS

The Office of Space Communications (OSC) provides long haul and space based communications services for NASA programs and installations.

3.3.1 Mission/Goals Description

The mission statements of OSC's three programs are stated below:

- **Space Network Program** -- provides tracking and relay services for spacecraft in low-Earth orbit and associated ground-system elements;
- **Ground Networks Program** -- provides tracking and data acquisition for launch vehicles and high altitude and deep space orbit spacecraft; and
- **Communications and Data Systems Program** -- provides operational and administrative communications, unmanned spaceflight scheduling and control, flight dynamics, data acquisition and processing, and telecommunications management.

The OSC has established the following strategic goals for information systems to support these missions:

- Provide a robust multi-mission information access infrastructure with appropriate security;
- Complete and enhance capabilities for acquisition and utilization of scientific data and information;
- Ensure capabilities for system evolution; and
- Ensure a balance between scope and budget.

These goals result in the following specific objectives:

- Provide the capability necessary to support effective science operations and analysis of growing volumes of space observation data;
- Provide flexibility and capacity in information systems to adapt to scientific opportunities and evolving needs;
- Ensure new systems readily incorporate new technology;
- Lower cost per bit of information processed, distributed, analyzed, and archived;

- Concentrate on infrastructure of services, functions, and systems required to serve multi-mission and multi-discipline needs; and

- Evolve future systems from those now in place or under development.

As a result of these missions, goals, and objectives, the OSC anticipates moving the NASA communications infrastructure technology in the following directions:

- Higher volumes of data gathered and transmitted;

- Less time required for data gathering and transmission;

- Decreased cost of data gathering and transmission;

- Increased usefulness of data gathered;

- Greater availability of data;

- Modular system architecture;

- Increased use of workstations and data archives;

- Availability of standardized software tools, common system utilities, and international networks;

- Increased international interaction; and

- Scientist/spacecraft instrument interaction.

3.3.2 Five Year IT Investment Projections

The OSC's projected total IT investments for the next five years are presented below and summarized in Exhibit 3-3. Investments are presented in $K (thousand dollars).

FY94	FY95	FY96	FY97	FY98
303,300	323,400	320,300	327,900	325,200

Space and Ground Network, Communications and Data Systems

FY94	FY95	FY96	FY97	FY98
287,100	306,300	301,600	308,300	304,900

Space Network provides tracking and relay services for spacecraft in low-Earth orbit and associated ground-system elements. Ground Network provides tracking and data acquisition for launch vehicles and high altitude and deep space orbit spacecraft. Communications and Data Systems provides operational administrative communications, unmanned space flight scheduling and control, flight dynamics, data acquisition and processing, and telecommunications management.

Tracking and Data Advanced Systems

FY94	FY95	FY96	FY97	FY98
3,600	3,900	4,100	4,400	4,600

Tracking and Data Advanced Systems conducts preliminary concept and requirement studies investigating prototype and test technology that will add new capabilities to, or improve performance of future tracking and data acquisition systems.

Nonprogrammatic Operating Account

FY94	FY95	FY96	FY97	FY98
12,600	13,200	14,500	15,200	15,700

Nonprogrammatic Operating Account provides administrative support for the Tracking and Data Advanced Systems and Space and Ground Network, Communications and Data Systems.

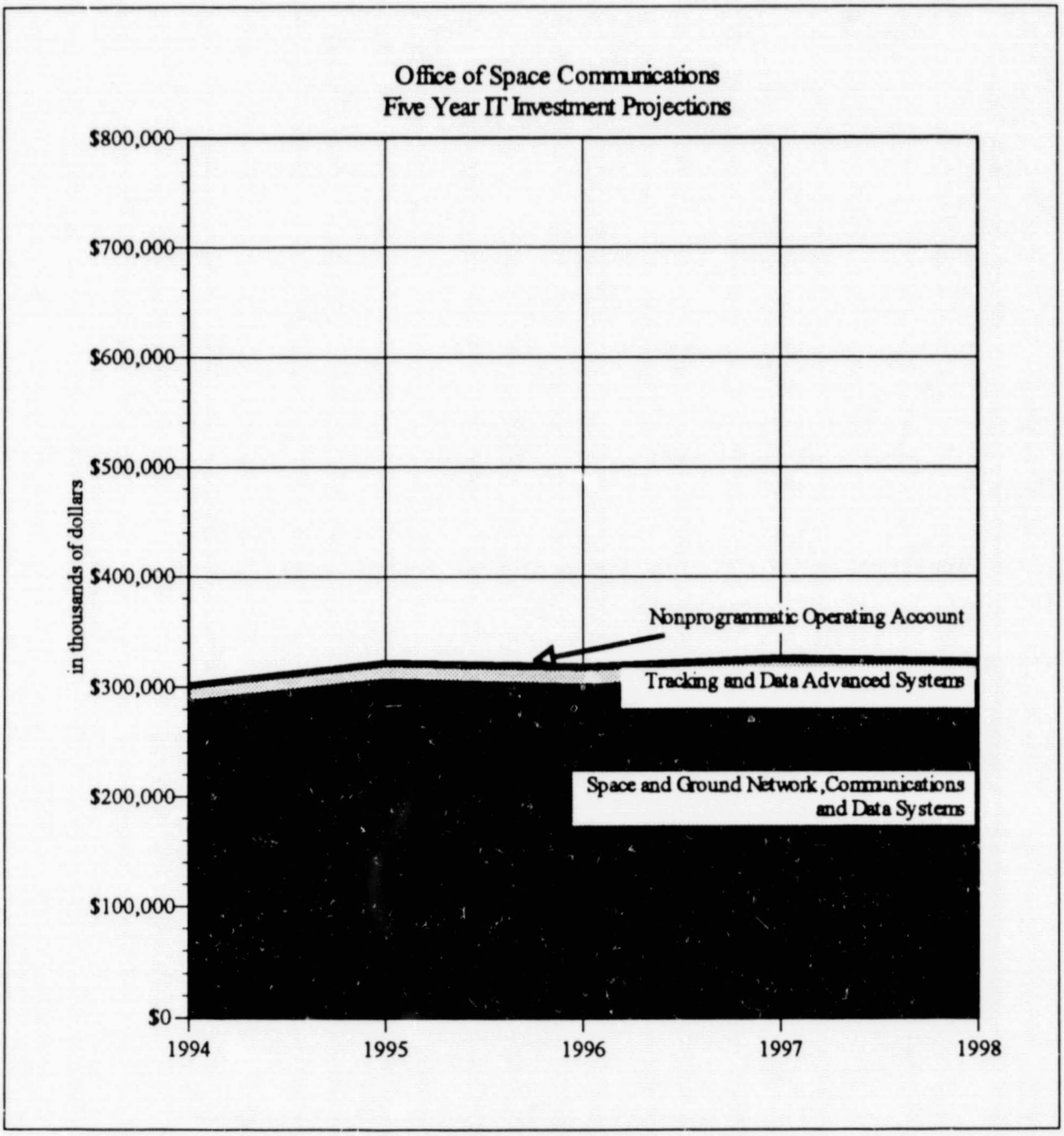

Exhibit 3-3. OSC Total IT Investments by Program.

3.3.3 Major IT Initiatives/Procurement

Nine major OSC IT initiatives are described in this section and summarized in Exhibit 3-4. A major IT initiative/procurement project is an undertaking for which the cost of system development and acquisition from concept definition through implementation will exceed $25 million, or the cost in any one year will exceed $10 million. The following major initiatives are funded primarily by OSC; however, the total figures presented may include funding from other Program Offices. Planned investments are presented in $K (thousand dollars). All runout costs include the cost of operations and maintenance of the systems.

Spacelab Input Processing System

FY94	FY95	FY96	FY97	FY98
12,100	12,700	11,000	10,500	7,000

Provides software development and operations for the Spacelab Input Processing System (SIPS). SIPS captures, demultiplexes, monitors, accounts for, and formats all experiment data from NASA's Spacelab and Shuttle attached payload missions.

Data Capture Facility

FY94	FY95	FY96	FY97	FY98
15,700	15,700	15,000	15,300	14,800

Provides operations for the Data Capture Facility (DCF). DCF includes the Packet Processor Facility and the Generic Time Division Multiplex (GTDM) Facility. The Packet Processor Facility performs the data capture and processing requirements for NASA's packet telemetry satellites. The GTDM Facility performs data capture and processing for missions utilizing time division multiplexed telemetry.

Data Systems Technology Test Bed

FY94	FY95	FY96	FY97	FY98
12,700	13,300	14,000	14,700	15,300

Provides a test bed for advancing the application of high payoff technologies, including automation, expert systems, man-machine interfaces, Very Large Scaled Integration, software methods, and information management systems.

NASA Communications System

FY94	FY95	FY96	FY97	FY98
76,000	79,600	87,800	92,500	96,000

Provides a global operational communications network in support of all flight projects, including near earth via the Tracking and Data Relay Satellite System and deep space initiatives such as Mars Observer, Galileo, and Magellan.

Tracking and Data Relay Satellite System

FY94	FY95	FY96	FY97	FY98
9,400	9,800	9,800	8,900	10,300

Provides operations and maintenance of the development environment, software development and modification, hardware acquisition, and supporting activities for Network Control Center development.

Satellite Operations Control Centers

FY94	FY95	FY96	FY97	FY98
31,200	32,200	30,000	29,300	32,800

Provides ADP operations, software, and hardware for the command and control of NASA's existing and future science and applications spacecraft.

Command Management System

FY94	FY95	FY96	FY97	FY98
22,800	25,100	24,800	23,200	21,100

Provides the ADP operations, software, and hardware to generate command loads for uplink to NASA's existing and upcoming science and applications spacecraft.

Flight Dynamics Facility

FY94	FY95	FY96	FY97	FY98
5,000	6,200	8,100	6,400	5,500

Provides orbit and attitude determination, mission analysis and planning, and network data acquisition planning of NASA's earth orbit flight missions.

Program Support Communications System

FY94	FY95	FY96	FY97	FY98
88,000	91,700	96,800	104,200	107,500

Provides the day-to-day communications among the NASA Centers including voice, data, and facsimile. Provides FTS-2000 service and the NASA-wide video teleconferencing system. Provides individual Program Code dedicated communications services.

	FY94	FY95	FY96	FY97	FY98
Spacelab Input Processing System	12,100	12,700	11,000	10,500	7,000
Data Capture Facility	15,700	15,700	15,000	15,300	14,800
Data Systems Technology Test Bed	12,700	13,300	14,000	14,700	15,300
NASA Communications System	76,000	79,600	87,800	92,500	96,000
Tracking and Data Relay Satellite System	9,400	9,800	9,800	8,900	10,300
Satellite Operations Control Centers	31,200	32,200	30,000	29,300	32,800
Command Management System	22,800	25,100	24,800	23,200	21,100
Flight Dynamics Facility	5,000	6,200	8,100	6,400	5,500
Program Support Communications System	42,900	47,900	52,600	57,500	60,000

Exhibit 3-4. List of Major Initiatives for OSC.

3.4. OFFICE OF AERONAUTICS

The Office of Aeronautics (OA) conducts NASA's research and technology development programs in support of national aeronautics goals, which are designed to promote NASA and U.S. leadership in aeronautics. The OA consists of a Headquarters program office and three field centers: Ames Research Center (ARC), Langley Research Center (LaRC), and Lewis Research Center (LeRC).

This office was formerly the Office of Aeronautics and Space Technology (OAST). In 1993, the Space Research and Technology Division was removed from OAST and combined with the Commercial Programs Office, creating the Office of Advanced Concepts and Technology (OACT). Information technology investments associated with OACT are addressed in Section 3.5.

3.4.1 Mission/Goals Description

The missions of OA's two research and technology programs are stated below:

- **Aeronautical Research and Technology** -- NASA's Aeronautical Research and Technology mission comprises four themes.

  - Civil Transportation: Support U.S. industry in the development of advanced technologies and concepts to improve aircraft and aviation system competitiveness, productivity, and environmental quality.

  - Advanced Applications: Lead the development of high-risk technologies and advanced vehicle concepts applicable to military aircraft, hypersonic and transatmospheric vehicles and far-term dual-use applications.

  - Critical Technologies and Capabilities: Conduct fundamental research in critical technologies; advance the development of computational tools and techniques; and provide access to world-class aeronautical facilities, technical expertise and assistance.

  - National Benefits: Lead the application of technology and management knowledge to appropriate national priorities of broad benefit to our society;

- **Transatmospheric Research and Technology** -- Secure future options and exploit the convergence of aeronautics and space technology for developing the capability to routinely cruise and maneuver into and out of the atmosphere, with takeoff and landing from conventional runways.

Strategic thrusts have been defined for the aeronautical research and technology programs to direct the activities that support the achievement of programmatic and national goals and missions. These thrusts respond to major areas of NASA's strategic interest and identify high-risk, high-payoff technologies that could further agency goals. Goals are presented for each program below.

Aeronautical Research and Technology

- Develop selected, high-leverage technologies and explore new means to ensure the competitiveness of U.S. Subsonic aircraft and to enhance the safety and productivity of the National Aviation System;

- Resolve critical environmental issues and establish the technical foundation for economical, high-speed air transportation;

- Ready technology options for revolutionary new capabilities in future high-performance fixed and rotary-wing aircraft;

- Develop critical technologies to support ground and flight demonstration of the X-30 National Aerospace Plane and future hypersonic vehicles;

- Pioneer fundamental research, cross-cutting technology development, and validation of numerical simulation techniques to maintain the theoretical, experimental, and predictive foundation required for design and operation of advanced aerospace systems;

- Develop, maintain, and operate critical national facilities for aeronautical research and support of industry, Department of Defense, and NASA programs;

- Foster the planned, early transfer of technology to U.S. aerospace and non-aerospace industries;

- Lead the development of technological advances that contribute to U.S. economic competitiveness, create jobs, and contribute positively to the U.S. balance of trade; and

- Develop and support university programs that foster basic research and develop future scientists and engineers, and provide programs and tools that aid elementary and secondary science and math education.

Transatmospheric Research and Technology

- Strategic thrusts and goals for Transatmospheric Research and Technology are currently being defined.

It is important to note that the nature of research and development has changed over the last ten years. Traditionally, Aeronautics programs relied almost exclusively on physical test facilities. Today, scientific and engineering computing plays a significant and growing role in NASA's research and development capability. The OA's programs depend on having effective and efficient scientific computing and communications systems to accomplish programmatic and agency goals. The OA has made, and continues to make, appropriate investments in information technology to ensure that computationally intensive research and technology programs have the resources to meet national needs in aeronautics and space.

3.4.2 Five Year IT Investment Projections

The OA's projected total IT investments for the next five years are presented below and in Exhibit 3-5. Investments are presented in $K (thousand dollars).

FY94	FY95	FY96	FY97	FY98
270,700	296,500	292,100	301,200	322,600

Over the next 5 years, the OA Research Centers, through the High Performance Computing and Communications Program and other development efforts, will be initiating a massively parallel processing capability to achieve computer processing speeds necessary to support the requirement for multi-disciplinary research and development. At the same time, growth in conventional supercomputing capability will be scaled back at each of the Centers. Any future growth will occur at a single, consolidated supercomputer site located at ARC. This strategy is designed to ensure the continuation of current capabilities while providing an infrastructure to support the smooth integration of new technologies, such as parallel processing, into the computing environment. Other investments will continue to be made in mass storage devices, scientific and engineering workstations, data acquisition/analysis systems, and networks.

This section provides OA financial projections for FY94-FY98. The three OA program areas with IT expenditures are Aeronautical Research and Technology, Transatmospheric Research and Technology, and Research Operations Support. A summary of the benefits of the expenditures for each program area is provided below. In most cases, multiple projects benefit from similar activities being pursued at each of the three Centers. Planned investments are presented in $K (thousand dollars).

Aeronautical Research and Technology

FY94	FY95	FY96	FY97	FY98
198,600	219,400	211,400	217,300	234,800

Central Scientific Computing IT initiatives include:

- Continue the Numerical Aerodynamic Simulation supercomputing capability to provide advanced high-speed processors with computational speed and memory size necessary to solve problems requiring high-speed visualization, and time-dependent and interdisciplinary solutions;

- Acquire massively parallel processing systems that will advance the state-of-the-art in high-speed processing with the goal of achieving a teraflop machine, essential for computational design of complete aerospace vehicle systems;

- Maintain the current base of conventional production supercomputing capability as a stable tool supporting computational research;

- Implement a consolidated conventional supercomputing capability at ARC to expand capabilities in high-speed processing, utilizing commercially available vector processors, which are appropriately balanced with supporting software, archival mass storage hardware, internal memory, and networks;

- Implement distributed mass storage systems, utilizing large-scale mass storage media directly connected to a high-speed network to provide unlimited system growth and allow the use of workstations, rather than supercomputers, as file servers;

- Enhance mini-supercomputer capability for interactive development of scientific programs; and

- Upgrade advanced computational concepts and visualization labs with state-of-the-art hardware and software systems for analysis and visualization of large scientific and engineering data bases, which result from numerical simulations on distributed and central computers and from experiments performed in ground and flight facilities.

Distributed Computing IT initiatives include:

- Upgrade distributed scientific and engineering workstations utilized by researchers to display high-quality surface and volume grids and supercomputer generated animations of time varying phenomena;

- Acquire CAD/CAM workstations for wind tunnel modeling and project hardware design; and

- Enhance VAX Cluster Central Processing Unit capability for general purpose scientific and engineering computing.

Facility Dedicated Computing IT initiatives include:

- Update the Rotor and National Transonic test facilities with upgraded data acquisition and reduction computers;
- Upgrade computer hardware to provide data acquisition and analysis for medium size test facilities; and
- Replace obsolete computer generated imaging system to support real-time flight simulation.

Communications IT initiatives include:

- Upgrade phased network bandwidth to 1,000 Mbps to support rapid network expansion and growing researcher requirements for high-resolution interactive graphics, image processing, full-motion video, CAD/CAM, and Center-wide mass storage access; and
- Install networking hardware to provide mainframe computer access, LANs and wide area networks (WANs), out-of-Center network access, personal computing services, and office support capability.

Transatmospheric Research and Technology

FY94	FY95	FY96	FY97	FY98
40	38	38	40	41

The Transatmospheric Research and Technology (TAV) budget is small relative to the other projects. A percentage of the TAV budget supports central scientific computing at the Centers commensurate with the benefit received by the program. Other TAV funds are used to procure scientific and engineering workstations that provide direct program support.

Research Operations Support

FY94	FY95	FY96	FY97	FY98
72,100	77,100	80,700	83,900	87,800

IT initiatives include:

- Upgrade aging personal computers and configure them for a client server environment to allow for more efficient and effective use of administrative data; and

- Upgrade administrative mainframe computers to the capacity necessary to support NASA's agency-wide business systems.

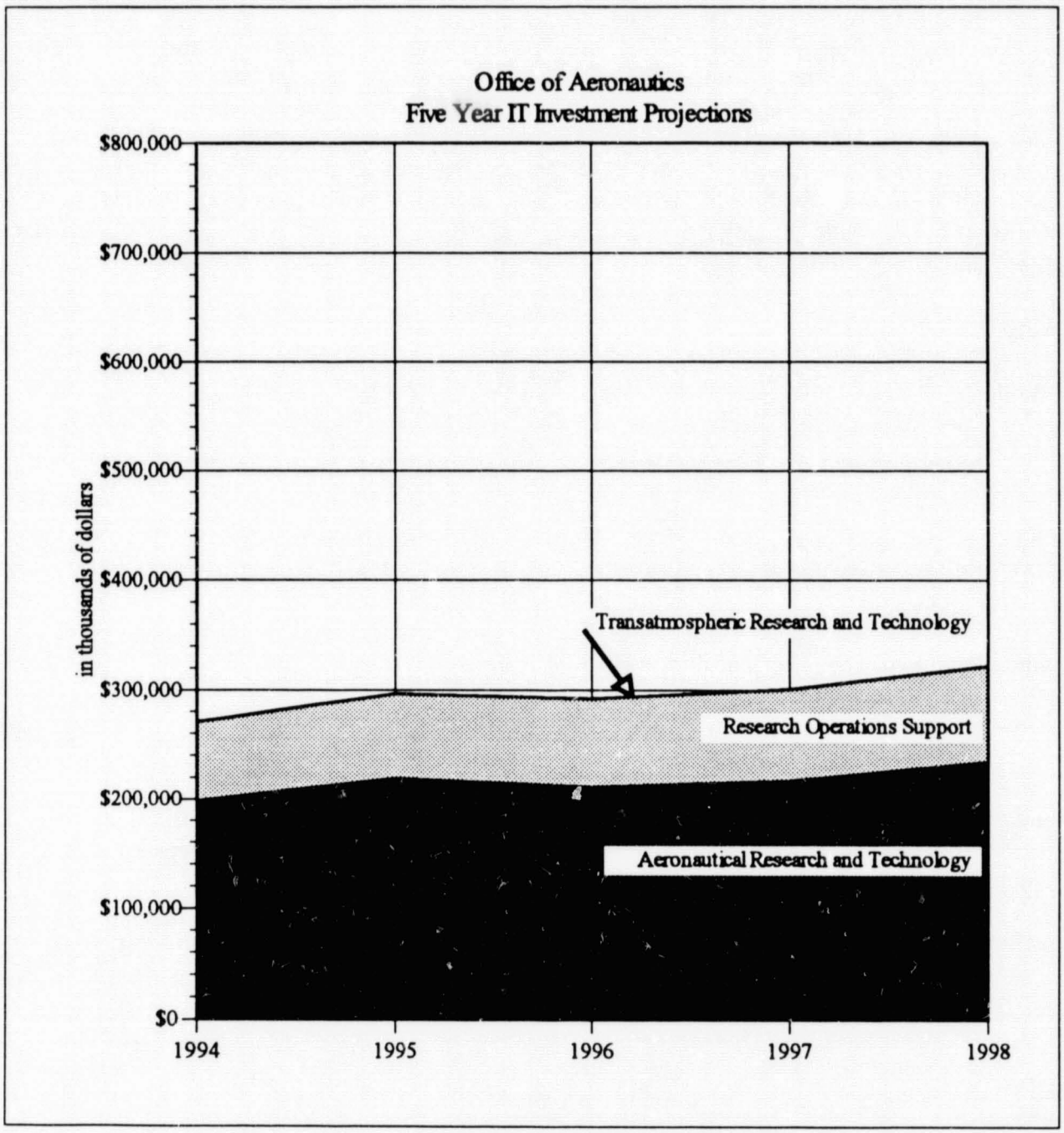

Exhibit 3-5. OA Total IT Investments by Program.

3.4.3 Major IT Initiatives/Procurement

Nine major OA IT initiatives are described in this section and summarized in Exhibit 3-6. These initiatives are grouped by Research Center. A major IT initiative/procurement project is an undertaking for which the cost of system development and acquisition from concept definition through implementation will exceed $25 million, or the cost in any one year will exceed $10 million. The following major initiatives are funded primarily by OA; however, the total figures presented may include funding from other Program Offices. Planned investments are presented in $K (thousand dollars).

Ames Research Center

Computer Systems and Research Division (Central Computer Facility)

FY94	FY95	FY96	FY97	FY98
18,400	19,000	19,600	20,200	20,400

Initiatives include increasing supercomputer capability by replacing the Cray YMP with a Cray C90, and upgrading mass storage, graphic visualization, center-wide software, and technical support services.

Numerical Aerodynamic Simulation Systems

FY94	FY95	FY96	FY97	FY98
45,300	47,500	49,400	51,600	53,200

Initiatives include upgrading the advanced large-scale computer system capability comprised of vector processing supercomputers, NAS Program System Network, parallel processing testbeds, simulation computer systems, and mass storage devices.

Ames High Performance Computing and Communication Program Consolidated ADP

FY94	FY95	FY96	FY97	FY98
14,900	23,400	13,600	8,400	22,500

Initiatives include the implementation of several highly parallel computer systems and software testbeds.

Information and Communications Systems

FY94	FY95	FY96	FY97	FY98
9,000	9,400	9,700	9,300	9,600

Initiatives include upgrading of administrative computing equipment, both mainframe and personal computers, to provide necessary capacity to support NASA's agency-wide business systems such as NEMS and NPPS, as well as Center-based applications such as the financial management and human resources systems. In addition, this activity includes upgrade of existing intra-Center voice and data networks.

Flight Systems and Simulation Research

FY94	FY95	FY96	FY97	FY98
3,400	3,700	3,900	4,600	5,000

Initiative focuses on maintenance and enhancement of the in-place vertical motion simulator. This facility provides realistic cockpit experiences under various simulated flight conditions.

Dryden Research Engineering Division

FY94	FY95	FY96	FY97	FY98
8,400	9,300	9,200	9,200	9,500

Initiative provides maintenance and upgrade of the data acquisition and analysis computers for multiple research facilities located at the Dryden Research Facility. The affected facilities include the Simulation Facility, Integrated Test Facility, Thermo Structures Facility, Data Analysis Facility, and the West Aeronautics Test Range.

Langley Research Center

Central Scientific Computer Complex

FY94	FY95	FY96	FY97	FY98
23,400	26,100	27,700	28,700	28,900

Initiatives focus on maintenance of in-place supercomputers and upgrading other elements of the Central Computer Facility including highly parallel processing testbeds, mass storage, software, simulation labs, and related peripheral equipment.

LaRC Business Data Processing System

FY94	FY95	FY96	FY97	FY98
5,200	6,900	7,100	7,400	7,700

Initiatives include upgrading aging personal computers and mainframes to provide necessary capacity to support NASA's agency-wide business systems such as NEMS and NPPS, as well as Center-based applications such as the financial management and human resources systems.

Lewis Research Center

High Speed Computational Systems

FY94	FY95	FY96	FY97	FY98
12,900	12,900	11,800	7,200	7,200

Initiatives focus on maintenance of in-place supercomputers and upgrading other elements of the Central Computer Facility including highly parallel processing testbeds, mass storage, data acquisition systems, and related peripheral equipment.

	FY94	FY95	FY96	FY97	FY98
Central Computer Facility	18,400	19,000	19,600	20,200	20,400
Numerical Aero-dynamic Simulation (NAS) Systems	45,300	47,500	49,400	51,600	53,200
High Performance Computing and Communication Program	14,900	23,400	13,600	8,400	22,500
Information and Communication System	9,000	9,400	9,700	9,300	9,600
Flight System and Simulation Research	3,400	3,700	3,900	4,600	5,000
Dryden Research Engineering Division	8,400	9,300	9,200	9,200	9,500
Central Scientific Computer Complex	23,400	26,100	27,700	28,700	28,900
Business Data Processing System	5,200	6,900	7,100	7,400	7,700
High Speed Computational Systems	12,900	12,900	11,800	7,200	7,200

Exhibit 3-6. List of Major Initiatives for OA.

3.5. OFFICE OF ADVANCED CONCEPTS AND TECHNOLOGY

The Office of Advanced Concepts and Technology (OACT) was created in 1993 by merging the Space Research and Technology Division of the Office of Aeronautics and Space Technology with the Commercial Programs Office.

3.5.1 Mission/Goals Description

The mission of the OACT is to pioneer innovative, customer-focused space concepts and technologies leveraged through industrial, academic and government alliances, to ensure U.S. commercial competitiveness and preeminence in space.

The following strategic goals will be used as a guide for establishing activities and planned accomplishments for the OACT:

- Be a center of systems engineering excellence performing concept definition and evaluation studies for NASA, industry, and commercial applications;
- Be a nationally recognized customer-oriented focal point for solicitation, evaluation and implementation of innovative technology and products for space and terrestrial applications;
- Establish new alliances and mechanisms to develop and transfer technology; create new, self-sustaining industries; improve performance; reduce costs; and demonstrate benefits and potential of dual-use technology;
- Develop and promote the unique attributes of space for new commercial products and services; and
- Establish and maintain a high quality, culturally diverse and creative workforce and environment.

3.5.2 Five Year IT Investment Projections

The OACT's projected total IT investments for the next five years are presented below and in Exhibit 3-7. Investments are presented in $K (thousand dollars).

FY94	FY95	FY96	FY97	FY98
36,100	36,100	37,900	38,800	39,300

Space Research and Technology

FY94	FY95	FY96	FY97	FY98
34,300	34,500	36,200	37,100	37,600

The majority of ADP investments made by the OACT provide partial funding for large scale initiatives undertaken by the Office of Aeronautics Research Centers in support of OACT technology programs. The OACT utilizes multiple categories of scientific and engineering ADP while performing research for NASA and commercial missions in the areas of communications, spacecraft and remote sensing, space processing, and transportation.

Central Scientific Computing IT initiative:

- Contribute funding to the Office of Aeronautics Research Centers' Central Computing Facilities commensurate with the use of supercomputing resources in the performance of space-related research.

Distributed Computing IT initiatives include:

- Upgrade distributed scientific and engineering workstations utilized by researchers to display computational fluid dynamics simulation data produced by supercomputers in a Research Center's Central Computing Facility; and

- Provide high resolution graphics terminals and workstations to enhance the interactive computer assisted research capability of CAD/CAM systems.

Facility Dedicated Computing IT initiatives include:

- Upgrade computer hardware to provide test monitoring, data acquisition, and data analysis for propulsion system test facilities, and structures lab data systems; and

- Acquire an X-ray diffraction system to support development of advanced metallic and polymeric materials systems.

Communications IT initiative:

- Contribute funding to the Office of Aeronautics Research Centers to support the installation of networking hardware to provide mainframe computer access, LANs and WANs, out-of-Center network access, personal computing services, and office support capability.

Technology Utilization

FY94	FY95	FY96	FY97	FY98
300	300	300	300	300

Commercial Use of Space

FY94	FY95	FY96	FY97	FY98
1,500	1,300	1,400	1,400	1,400

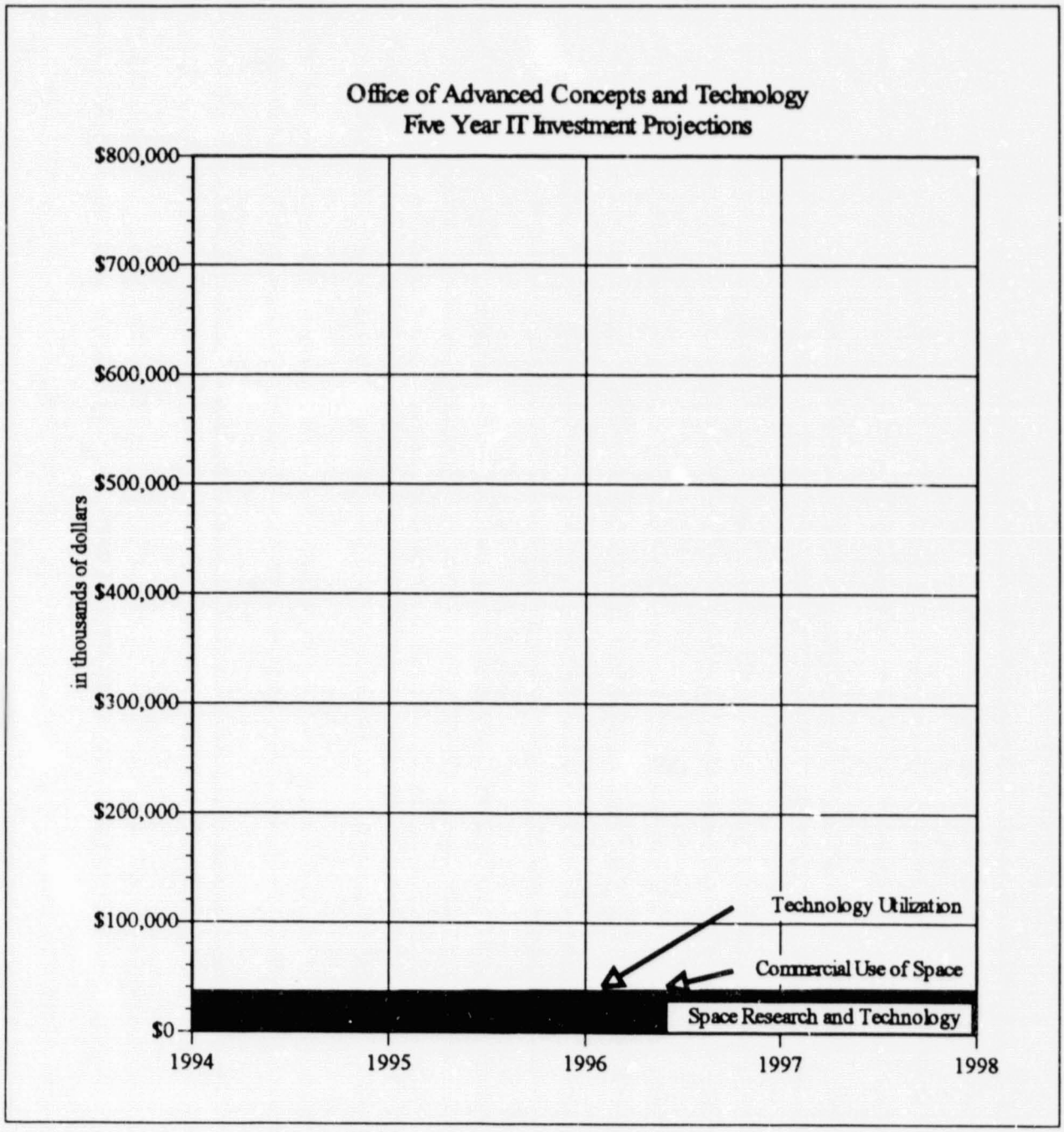

Exhibit 3-7. OACT Total IT Investments by Program.

3.5.3 Major IT Initiatives/Procurement

A major IT initiative/procurement project is an undertaking for which the cost of system development and acquisition from concept definition through implementation will exceed $25 million, or the cost in any one year will exceed $10 million. The OACT has no IT procurement projects that meet the criteria of being a major initiative.

3.6. OFFICE OF SPACE SCIENCE

The Office of Space Science (OSS) has been recently established as a result of the reorganization of the Office of Space Science and Applications. The OSS plans, directs, executes, and evaluates NASA programs that use space-based and ground-based techniques to further understanding of the origin and evolution of our Sun, the solar system, and our Universe. The OSS is also responsible for applying this understanding to solve practical problems on Earth and provide scientific and technical research as a basis for expanding human presence beyond Earth orbit into the solar system. The OSS has contractual oversight of IRM activities of the Jet Propulsion Laboratory (JPL).

3.6.1 Mission/Goals Description

The scope of the OSS efforts ranges from study of the geospace environment to most distant galaxies. The pursuit of these objectives results in the development of tools, techniques, and procedures, which contribute to America's economic growth.

The OSS consists of three major program areas: Astrophysics, Solar System Exploration, and Space Physics. Each area is responsible for the overall administration of their own data management activities in accordance with OSS program directives. All OSS programs are involved in developing a central Data Archive facility to preserve data collected from space and/or Critical Ground Studies and make this data available to the scientific community world-wide.

The OSS' three program areas and their goals are as follows:

Astrophysics

- Study the origin and evolution of the universe and the fundamental physical laws of nature using high sensitivity and resolution instruments across the entire electromagnetic spectrum.

Solar System Exploration

- Study the present nature of the solar system, its planets, moons, and primitive bodies (asteroids and comets).

- Conduct research to identify and locate other planetary systems in various stages of formation to understand how our solar system was formed and evolved.

Space Physics

- Study the physical behavior of the Sun as a star; as an influence on Earth; and as the dominant source of energy, plasma, and energetic particles in the solar system.

- Study the interactions between the solar wind and solar system bodies.

Collecting data and transforming it into knowledge and discovery are fundamental activities of the space science community. Enabling activities in data storage, transmission, and scientific computing are critical to the success of space science. OSS-wide information systems needs in these areas for the above mentioned programs are coordinated by the Technology and Information Systems Office.

3.6.2 Five Year IT Investment Projections

The OSS's projected total IT investments for the next five years are presented below. Each total includes capital investments, equipment rental, space and other operating costs, commercial services, and interagency services. Investments are presented in $K (thousand dollars)

FY94	FY95	FY96	FY97	FY98
78,300	80,700	66,000	58,500	58,500

IT expenditures for the OSS are grouped into two categories: Planetary Exploration and Physics and Astronomy.

Planetary Exploration

FY94	FY95	FY96	FY97	FY98
34,500	36,300	29,100	23,400	21,700

The exchange of data collected from various planetary missions is made possible through the major networking activity performed at JPL for the planetary science community.

Physics and Astronomy

FY94	FY95	FY96	FY97	FY98
43,800	44,400	36,900	35,100	36,800

Contemporaneous observations across the entire electromagnetic spectrum are made possible through major networking activity performed at GSFC for the astrophysics community, including universities and scientists, as well as all of NASA.

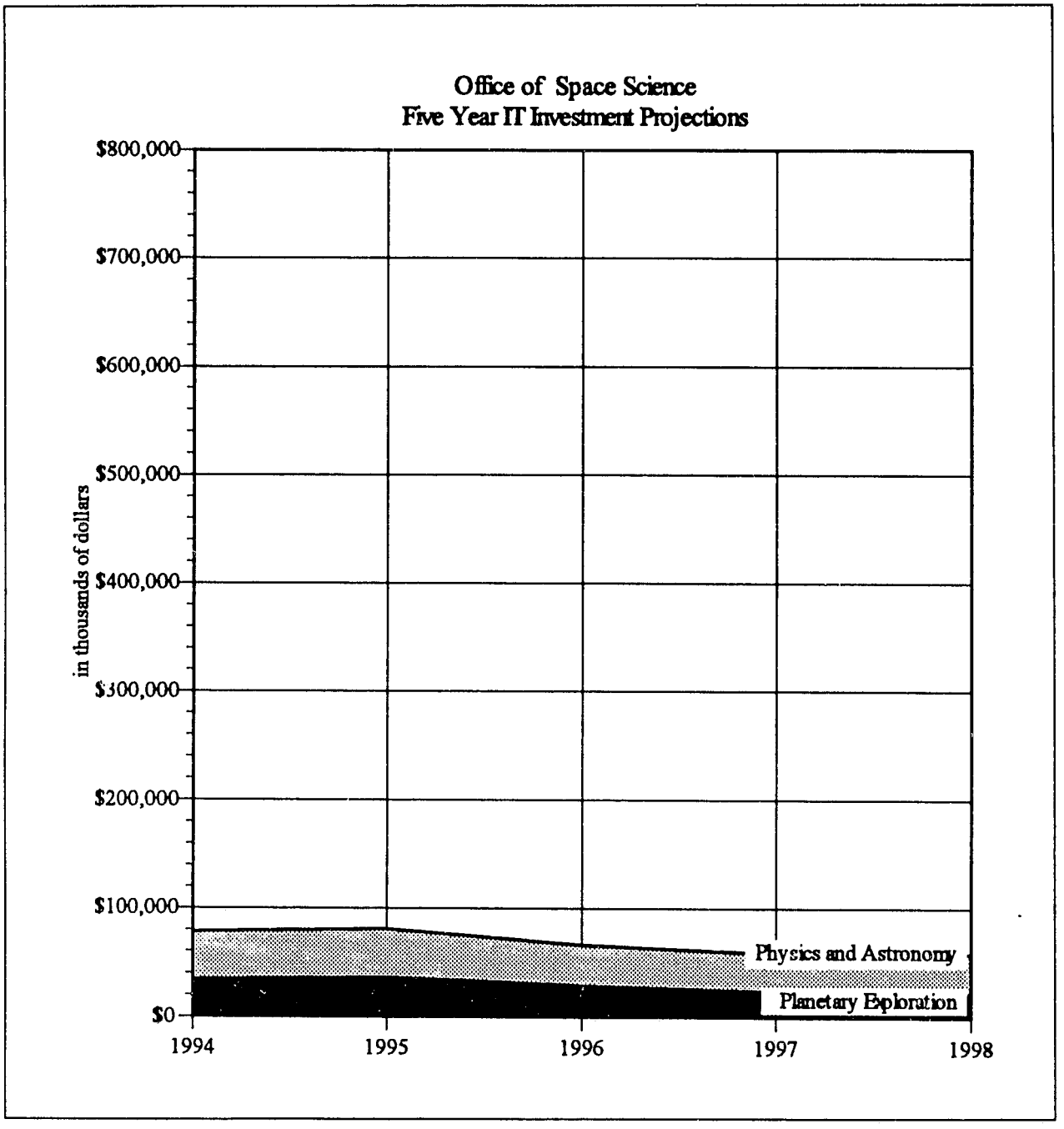

Exhibit 3-8. OSS Total IT Investments by Program.

3.6.3 Major IT Initiatives/Procurement

Four major OSS IT initiatives are described in this section and summarized in Exhibit 3-9. A major IT initiative/procurement project is an undertaking for which the cost of system development and acquisition from concept definition through implementation will exceed $25 million, or the cost in any one year will exceed $10 million. The following major initiatives are funded primarily by OSS; however, the total figures presented may include funding from other Program Offices. Planned investments are presented in $K (thousand dollars).

Astronomy and Solar Physics Data Analysis

FY94	FY95	FY96	FY97	FY98
--Procurement Sensitive--				

Performs science data services, primarily for the Cosmic Background Explorer mission, but also for other Astrophysics and Space Physics spacecraft; develops software; performs data reduction; and provides analyses in support of mission science.

Hubble Space Telescope Missions Operations, Systems Engineering, and Software

FY94	FY95	FY96	FY97	FY98
3,600	3,600	3,700	3,900	4,500

Performs support services for Hubble Space Telescope mission operations; provides operations engineering services; develops and tests flight software; and performs independent verification and validation.

NASA Science Internet

FY94	FY95	FY96	FY97	FY98
5,800	6,200	6,600	7,100	7,600

The objectives of the NSI networking function are to provide computer networking services, management and operations support, and technical assistance to the OSS science community. NSI provides NASA's authorized principal investigator and discipline scientists rapid and reliable communications access to colleagues, mission data archives, and computational facilities throughout NASA Centers and research institutions world-wide.

National Space Science Data Center

FY94	FY95	FY96	FY97	FY98
7,200	7,700	8,100	8,500	8,900

The NSSDC serves as the permanent long-term archive and distribution center for a broad range of OSS space science satellite data and information. It is responsible for archiving and dissemination of scientific data from specific astrophysics, space physics, and other discipline missions as appropriate.

	FY94	FY95	FY96	FY97	FY98
Astronomy and Solar Physics Data Analysis		-- Procurement Sensitive --			
Hubble Space Telescope Missions Operations, Systems Engineering, and Software	3,600	3,600	3,700	3,900	4,500
NASA Science Internet	5,800	6,200	6,600	7,100	7,600
National Space Science Data Center	7,200	7,700	8,100	8,500	8,900

Exhibit 3-9. List of Major Initiatives for OSS.

3.7. OFFICE OF MISSION TO PLANET EARTH

The Office of Mission to Planet Earth (MTPE) has been recently established as a result of the reorganization of the Office Space Science and Applications. The MTPE plans, directs, executes, and evaluates the collection and analysis of scientific information about global environmental change. The MTPE is a comprehensive program of satellite measurements, ground-based observations, a data and information system, modeling, and interdisciplinary process studies to understand how the Earth's climate works, and in particular, how human activities are affecting it. The MTPE has IRM oversight for the Goddard Space Flight Center (GSFC).

3.7.1 Mission/Goals Description

The MTPE studies the Earth and its environment as a unified system, including it's interactive processes--both natural and anthropogenic. The MTPE is structured to address issues determined to be of highest priority by the international science community. These issues are:

- The role of the clouds, radiation, water vapor, and precipitation;
- The productivity of the oceans, their circulation and air-sea exchange;
- The sources and sinks of greenhouse gases, and their atmospheric transformations;
- Changes in land use, land cover, primary productivity, and the water cycle;
- The role of polar ice sheets and sea level;
- The coupling of ozone chemistry with climate and biosphere; and
- The role of volcanoes in climate change.

Science objectives for MTPE have been established with these key uncertainties in mind.

3.7.2 Five Year IT Investment Projections

The MTPE's projected total IT investments for the next five years are presented below. Investments are presented in $K (thousand dollars). The structure for allocation of the projected IT investment to MTPE's programs is currently being developed and thus was not available for providing a program breakout for this document.

FY94	FY95	FY96	FY97	FY98
198,700	239,200	261,700	284,700	273,200

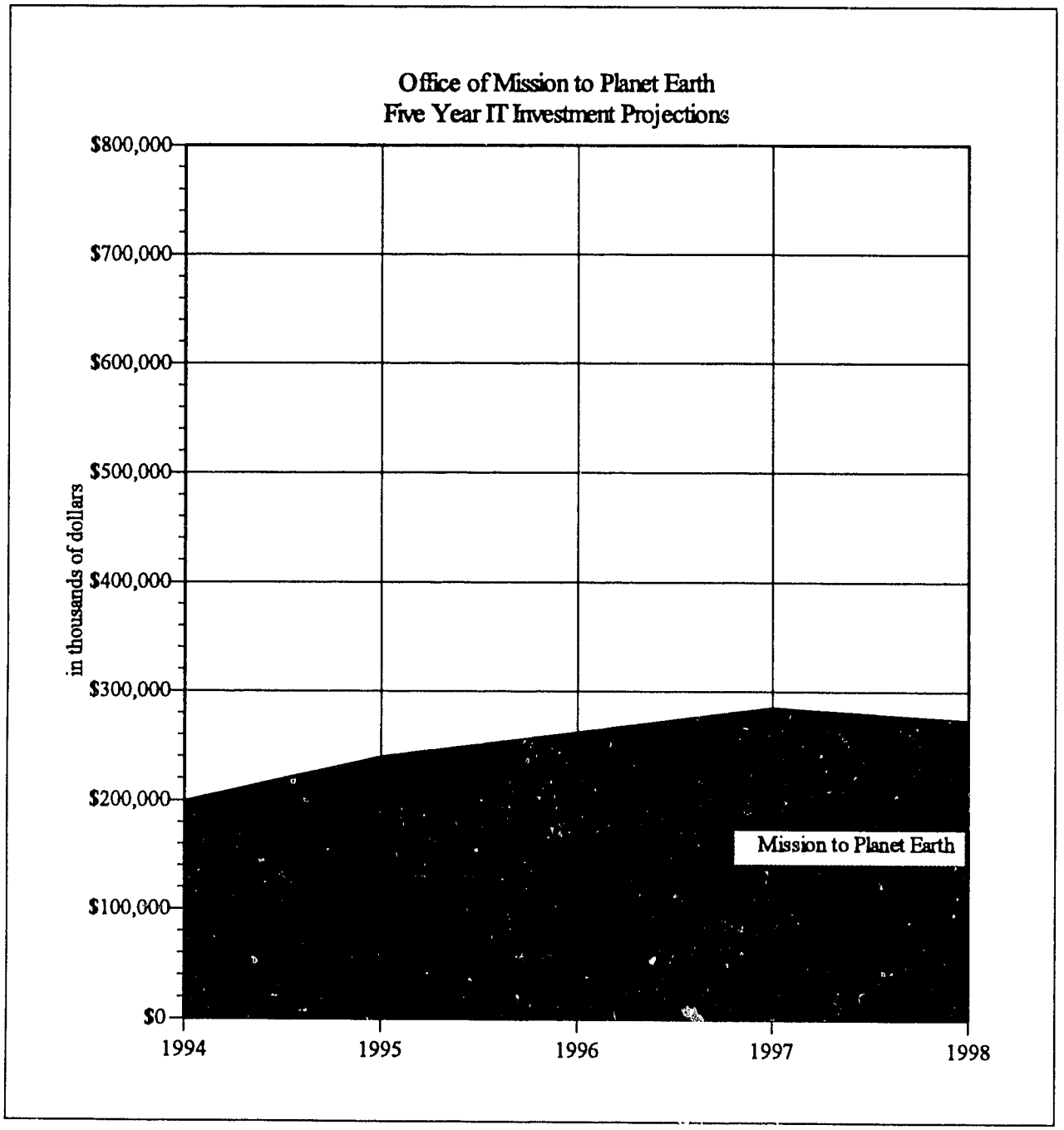

Exhibit 3-10. MTPE Total IT Investments

3.7.3 Major IT Initiatives/Procurement

Three major MTPE IT initiatives are described in this section and summarized in Exhibit 3-11. A major IT initiative/procurement project is an undertaking for which the cost of system development and acquisition from concept definition through implementation will exceed $25 million, or the cost in any one year will exceed $10 million. The following major initiatives are funded primarily by MTPE; however, the total figures presented may include funding from other Program Offices. Planned investments are presented in $K (thousand dollars).

Earth Observing System Data Information System (EOSDIS)

FY94	FY95	FY96	FY97	FY98
52,000	93,000	113,000	129,000	120,500

Information is key to the MTPE. The EOSDIS will make data quickly and easily accessible to scientists and other users in the U.S. and throughout the world. Standard, reliable, calibrated data products provided by EOSDIS will be essential to accomplish our overriding goal--understanding, assessing, and predicting global change. The EOSDIS includes components for Core System and Data Operations. These components are discussed below.

In March 1993, a contract for the EOSDIS Core System (ECS) was awarded to Hughes Applied Information Systems, Inc. Major deliveries for ECS begin in 1995 with increasing capabilities that will lead to an operational system supporting the EOS-AM1 spacecraft in mid 1998. The ECS, a Trail Boss procurement, is a system that includes 1) centralized mission and instrument command and control; 2) those product generation, information management, and data archive and distribution functions that are common to all Distributed Active Archive Centers; 3) Systems Engineering; and 4) Operations.

Data Operations is part of the EOSDIS program and is the interface between the Space Network and EOSDIS information centers. The system will capture spacecraft data, provide communications processing, distribute data to at least eight Distributed Active Archive Centers, and maintain a backup archive.

National Center for Computational Sciences

FY94	FY95	FY96	FY97	FY98
9,800	10,300	10,800	11,300	12,000

Performs supercomputing activity that accommodates both Space and Earth Science research. This is a Class II system that extends world-wide through the NASA Science Internet. Research endeavors, such as ozone layer simulation over the Arctic, are conducted on this system. Plans

cover the lease of ADP hardware, lease of software, ADPE maintenance, and analysis/programming in support of multiple projects for the next five years.

Applications Image Processing System

FY94	FY95	FY96	FY97	FY98
7,400	8,100	8,300	5,200	400

A collection of computer systems primarily devoted to the processing of image type data from Earth and space viewing instrumentation as well as computers associated with the High Performance Computing and Communications Program (HPCCP). The intent of HPCCP is to assist the space and Earth Science users in meeting the Grand Challenge problems. The system also includes support for the Office of Space Science's Physics and Astronomy Program. Notable recent achievements include the selecting and awarding of Investigator Teams for HPCCP in March 1993.

	FY94	FY95	FY96	FY97	FY98
Earth Observing System Data Information System (EOSDIS)	52,000	93,000	113,000	129,000	120,500
National Center for Computational Sciences	9,800	10,300	10,800	11,300	12,000
Applications Image Processing System	7,400	8,100	8,300	5,200	400

Exhibit 3-11. List of Major Initiatives for MTPE.

3.8. OFFICE OF LIFE AND MICROGRAVITY SCIENCES AND APPLICATIONS

The Office of Life and Microgravity Sciences and Applications (OLMSA) has been recently established as a result of the reorganization of the Office of Space Science and Applications.

3.8.1 Mission/Goals Description

The mission statements, goals, and objectives for the OLMSA are currently under development and are not available for this document.

3.8.2 Five Year IT Investment Projections

The OLMSA's projected total IT investments for the next five years are not available for this document. IT investment projections are expected to change as programs and projects are defined.

3.8.3 Major IT Initiatives/Procurement

A major IT initiative/procurement project is an undertaking for which the cost of system development and acquisition from concept definition through implementation will exceed $25 million, or the cost in any one year will exceed $10 million. The OLMSA has no IT procurement projects that meet the criteria of being a major initiative.

3.9. OFFICE OF MANAGEMENT SYSTEMS AND FACILITIES

The Office of Management Systems and Facilities (OMSF) provides overall coordination for agencywide functional management of the various IRM areas described in Section 1. To improve the overall management of information resources agencywide, NASA's IRM organization has wholeheartedly embraced continual process improvement as an IRM subdiscipline. Process improvement activities are underway and anticipated in a number of IRM areas, including IRM strategic planning, information technology system planning and budgeting, and IRM review and evaluation.

3.9.1 Mission/Goals Description

In addition to overall coordination of IRM policy, OMSF provides direct support of NASA's missions and programs through management of the Headquarters institution and operation of the Scientific and Technical Information (STI) and the Automated Information Management (AIM) Programs. The mission and goals for each of these programs are stated below.

Scientific and Technical Information Program

The Scientific and Technical Information (STI) Program was established as a result of the Space Act of 1958 to provide the widest appropriate dissemination of NASA research and development results, and to preserve the role of the United States as a leader in aeronautical and space science technology. The STI Program's mission is to identify world-wide sources of scientific, technical, engineering and related information; develop required policy statements; facilitate authorized access; and manage delivery of the information to NASA and its customer base.

The primary functions of the STI Program are to transfer technology from NASA to private industry, provide a current awareness mechanism for the NASA community, serve as a science education tool, provide an archival repository, and perform as an information policy source. The Program collects STI from many sources including NASA technical reports and patents, NASA contractor reports, and a variety of open literature sources; other U.S. government organizations through cooperative agreements; and other countries and international organizations through exchange agreements.

During the next five years, the STI exchange partners will be transitioning to an electronic document processing environment. To meet the STI mission-critical agreements with these partners effectively, the STI Program must position itself to receive and process information in standard electronic formats. The upgrade strategy that was approved in February 1993 relies on standard evolutionary acquisition and development methods, emphasizing the gradual selection and integration of proven commercial and government off-the-shelf information technology.

Accordingly, the Information Technology initiatives being pursued by the STI Program in FY94-FY98 include network upgrades for the existing information infrastructure, full text and image retrieval, electronic document interchange, machine translations, video and multimedia initiatives, graphical user interface and gateway applications, optical imaging, management information software implementation, expert search assistant, data manipulation tools, and planning and integration tools.

Automated Information Management Program

The Automated Information Management (AIM) Program directly supports the NASA strategic thrust to strengthen its business and technical management systems and use state-of-the-art information technology to improve systems and processes. The mission of the AIM Program is to improve the delivery of NASA-wide administrative ADP support through the identification, analysis, design, development, implementation, and maintenance of standard agencywide administrative ADP systems.

The AIM Program supports a number of proposed NASA IRM strategic goals which relate to business/institutional management systems:

- Manage information as an Agency resource;
- Adopt NASA-wide standards that encourage portability, interoperability, and connectivity; and
- Advance the application of software engineering practices within NASA.

The supporting goals of the AIM Program include:

- Develop and maintain an optimal set of agencywide automated institutional information management system capabilities consistent with sound management and technical practice;
- Define and establish an infrastructure (an information architecture composed of data, application, and technical components) that allow the designated set of AIM systems to be centrally developed and operated in standard decentralized locations with appropriate data sharing and interoperability; and
- Define and implement a systems development lifecycle methodology that incorporates an information engineering approach and addresses the NASA functional and institutional environment.

To ensure optimal data sharing and application maintainability, the AIM Program has implemented a data administration effort addressing top level data and process models for all

NASA business areas and includes appropriate data standards. The information engineering concept incorporated into the AIM lifecycle methodology promotes the effective use of techniques, methodologies, principles, and tools in a cohesive, rigorous approach to ensure that business functions of the agency are successfully supported through the developed AIM systems.

3.9.2 Five Year IT Investment Projections

The OMSF's projected total IT investments for the next five years are presented below. Investments are presented in $K (thousand dollars).

FY94	FY95	FY96	FY97	FY98
121,400	129,300	96,600	111,200	95,500

The three OMSF programs with IRM expenditures are Headquarters Institution, the Scientific and Technical Information Program, and the Automated Information Management Program. One other Headquarters program with IRM expenditures is also included from the Office of Human Resources and Education. Projected investments for each program are provided below.

Headquarters Institution

FY94	FY95	FY96	FY97	FY98
86,500	98,100	59,400	77,100	61,900

Local administrative and operational programs required to support each of the institutional systems, including business systems, general office automation, and FIP resources to support Headquarters administrative operations. Also includes headquarters personnel and facilities costs.

Scientific and Technical Information Program

FY94	FY95	FY96	FY97	FY98
14,100	14,600	15,200	14,800	15,400

Provides repositing of scientific and technical information for technology transfer to private industry and for use by NASA scientists and engineers.

Automated Information Management Program

FY94	FY95	FY96	FY97	FY98
20,500	16,200	21,600	18,900	17,800

The AIM Program requires significant IT investments for the development and maintenance of application systems; the definition of data, application, and technical architectures; and the

development of a standard lifecycle methodology. The NASA Field Installations separately provide funding for the standard technical environments that host the AIM systems.

Academic Programs

FY94	FY95	FY96	FY97	FY98
300	400	400	400	400

Education products provided by the Office of Human Resources and Education to educational institutions.

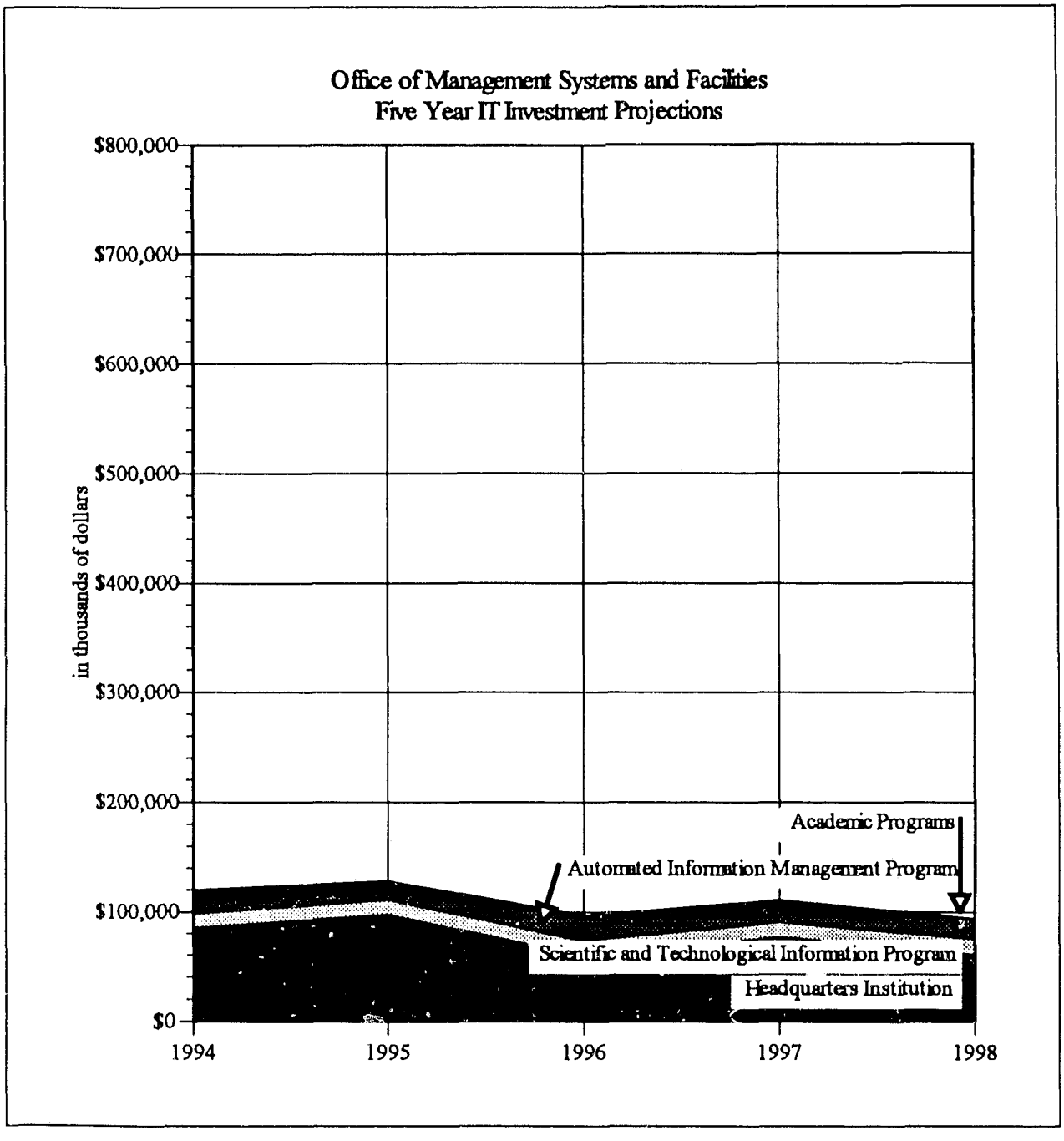

Exhibit 3-12. OMSF Total IT Investments by Program.

3.9.3 Major IT Initiatives/Procurement

One major OMSF IT initiative is described in this section. A major IT initiative/procurement project is an undertaking for which the cost of system development and acquisition from concept definition through implementation will exceed $25 million, or the cost in any one year will exceed $10 million. The following major initiative is funded primarily by OMSF; however, the total figures presented may include funding from other Program Offices. Planned investments are presented in $K (thousand dollars).

NASA Accounting and Financial Information System (NAFIS)

FY94	FY95	FY96	FY97	FY98
8,200	6,700	5,600	2,700	3,000

NASA initiated the NAFIS project to standardize its accounting systems Agencywide, achieve potential cost savings, and meet the Office of Management and Budget mandates for financial systems improvement. This project includes the development of a standardized Installation-Level Accounting System, which is to operate at each of NASA's eight Field Centers and Headquarters, and the redevelopment of the existing Agencywide Reporting System that will be used by NASA Headquarters to consolidate and report financial data received from the Field Installations.

3.10. OFFICE OF SAFETY AND MISSION ASSURANCE

The Office of Safety and Mission Assurance (OSMA) provides leadership in the development and optimization of safety and mission assurance policies, strategies, and technologies for NASA programs. The OSMA is responsible for putting into place the proper processes and disciplines to ensure that safety and quality remain top priorities in all NASA programs and projects. Initiatives to improve the Agency's risk management capabilities are sponsored by this Office.

3.10.1 Mission/Goals Description

The OSMA requires information technology to support its overall mission. A wide variety of information is required to support independent assessments, trend analyses, risk management, and oversight activities. The OSMA's mission comprises the areas and objectives described below.

- **Engineering** -- Establish NASA-wide standards, practices, and processes to support the design, manufacture, and testing of flight systems. Develop systems engineering practices and tools. Develop software policy, standards, procedures, and metrics to improve the software process. Develop practices and tools to evaluate the quality of software used in NASA's critical flight and ground systems and to ensure software meets program demands.

- **Independent Verification and Validation (IV&V)** -- Develop applications for IV&V technology in conjunction with West Virginia University. Conduct IV&V for major flight-related software.

- **Quality Assurance** -- Develop an integrated NASA-wide Quality Assurance program. Program elements include supplier quality assurance, mechanical parts, workmanship standards, nondestructive evaluation, and measurement assurance.

- **Quality Management for Payloads** -- Improve quality in NASA payload programs through more effective implementation of Safety, Reliability, Maintainability, and Quality Assurance (SRM&QA) disciplines in the early phases of the project life cycle.

- **Safety and Risk Management** -- Provide oversight of and support to all NASA activities. Major areas of emphasis are risk management, systems effectiveness, operational safety, emergency preparedness, safety training, and information systems development.

- **Space Flight Safety and Mission Assurance** -- Ensure implementation of common SRM&QA policies for flight programs. Conduct independent SRM&QA assessments of mission readiness. Identify channels to promote rapid assurance technology transfer. Develop and manage the safety and product assurance program for the Space Station Freedom Program. Review and assess implementation of assurance requirements.

Specific IT goals supporting the OSMA mission and goals are as follows:

- Develop Strategic Information Systems Plan to ensure alignment of business strategy and IT architecture.
- Develop integrated information systems that support risk management and all assurance activities as identified in the OSMA business plan.
- Develop and assure implementation of software policy, standards, procedures, and metrics for flight systems software development.
- Manage information as a valuable resource.
- Provide ADP services and support for OSMA computer users.
- Establish an IV&V facility.

3.10.2 Five Year IT Investment Projections

The OSMA's projected total IT investments for the next five years are presented below. Investments are presented in $K (thousand dollars).

FY94	FY95	FY96	FY97	FY98
6,500	7,100	7,500	7,500	7,100

IT investments are almost equally divided among information systems development, software engineering and assurance, and operation of the IV&V facility.

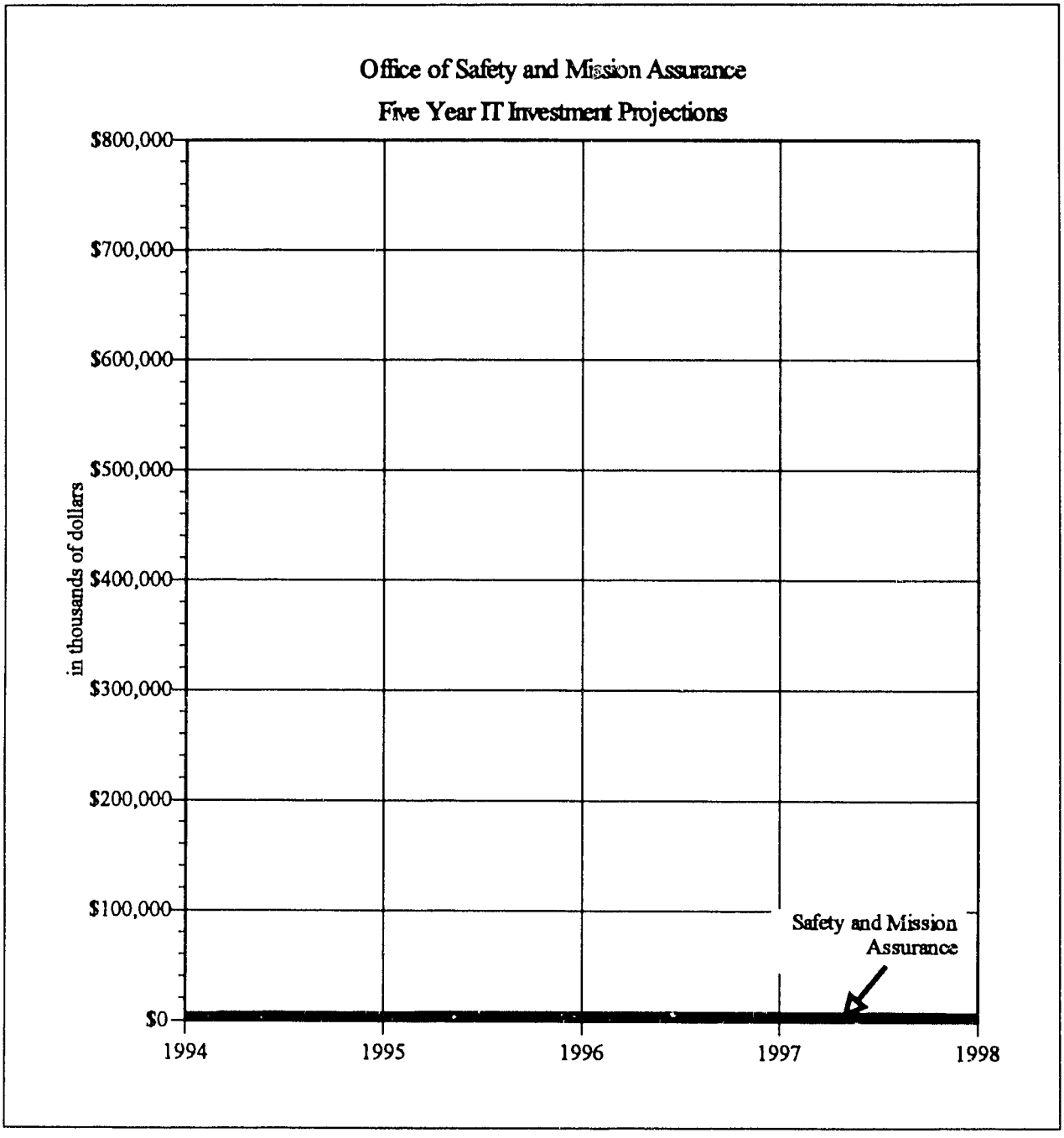

Exhibit 3-13. OSMA Total IT Investments.

3.10.3 Major IT Initiatives/Procurement

A major IT initiative/procurement project is an undertaking for which the cost of system development and acquisition from concept definition through implementation will exceed $25 million, or the cost in any one year will exceed $10 million. The OSMA has no IT procurement projects that meet the criteria of being a major initiative.

4. MAJOR IRM PROGRAM ACCOMPLISHMENTS FOR FY 1992

4.1. OFFICE OF SPACE FLIGHT

The OSF's IRM Directors worked together this past year to develop and formalize their Information Resources Oversight Council (IROC). The IROC members represent each of the OSF centers and meet regularly to discuss policies, reporting requirements, and opportunities for improvement in IRM. They are committed to developing an enterprise view of IRM for the Centers and the OSF Programs.

A FIP Resources team was formed to review management of OSF Information Resources. The team established a baseline for identifying common business definitions and approaches. They also determined baselines for measurements to allow a relative assessment of institutional health across Centers and Programs.

An Information Technology working group with members from each Center met throughout the year to develop operational standards for transferring common administrative documents between the different systems of the OSF Centers.

Eight Space Shuttle missions were flown in 1993. Information Technology initiatives that played a major role in the Space Shuttle Program were:

- The Flight Analysis and Design System (FADS) was completed at JSC. This application tailors generic software to meet the specific needs of each mission.
- Installation of the Shuttle Drawing System began at KSC and JSC.
- A monitoring and diagnostic system for the Space Shuttle LOX loading process was implemented.

During FY92, a number of technical and acquisition-related activities have been accomplished. An option was exercised within the Engineering Analysis and Data System contract for the buy-out of all leased hardware. The buy-out enabled MSFC to save more than $1,000,000 in lease cost over the remainder of the contract. This action also transferred title of the Cray X-MP/416 supercomputer to the Government, allowing us to utilize this machine beyond the contract life. MSFC also awarded a contract for Engineering Analysis and Data System II, which will provide scientific and engineering computational capabilities for the center over the next 8 years.

4.2. OFFICE OF SPACE SYSTEM DEVELOPMENT

During FY92, the Space Station Freedom Technical and Management Information System (TMIS) continued to develop applications and databases to support critical program activities and to manage the supporting network, host, and workstation infrastructure. The TMIS architecture supports user access to data from 12 domestic and 10 international locations. The local wide-area network infrastructure provides access to 10 host computers at Level II and Level III locations. Over 30 major applications are in production and/or development to allow access to program data, which support management, engineering, drawing, analysis, utilization, operations, and safety, reliability, maintainability, and quality assurance functions.

In FY93, the Flight Systems Space Transportation Main Engine (STME) project completed a data communications and transfer network between the Space Transportation Propulsion Team member plants, the NASA centers and the DoD centers involved in the STME/National Launch System design. This effort was led by MSFC and aided by the accessibility of the NASA PSCN systems.

4.3. OFFICE OF SPACE COMMUNICATIONS

NASA completed negotiations with the General Services Administration and AT&T for acceptance of the Network Service Assurance Plan (NSAP) contract modification. NASA transferred all administrative and non-operational telecommunications services to the FTS-2000 service provider effective April 30, 1993. NSAP provides dedicated transmission service users with a guaranteed level of service and reliability, including fewer failures on dedicated circuits, significantly less restoration time, easier network access, flagging and tagging to establish restoration priority to critical circuits, delivery of spare equipment to the user's site, redundant circuits, circuit reconfiguration, extended maintenance hours, and on-site AT&T technicians for special coverage. NASA selects from a menu of assurance plan options that will collectively satisfy their mission critical needs. The NASA operational network has a plan to effect a similar transfer during FY93 and FY94.

4.4. OFFICE OF AERONAUTICS

In FY92, a Supercomputing Strategy Team was formed to identify alternatives for achieving more effective large-scale computing capability to support the OA programs with increased emphasis on improved cost effectiveness. One result of that activity was the development of an integrated OA supercomputing strategy that would constrain overall conventional supercomputing capacity, consolidate future conventional supercomputing capability growth at a single shared facility located at ARC, and accelerate the development of highly parallel processing to meet future supercomputing needs. By pursuing this strategy, OA expects to achieve a savings in the area of supercomputing of $34M over five years.

Initial plans called for the implementation of a Shared Facility by FY94. The creation of a centralized OA supercomputing facility will require an unprecedented degree of inter-Center cooperation. Implementation planning to achieve that goal is currently underway.

Proposals to provide increased supercomputing capability through the recompetition of ARC computational capabilities contract were received and evaluated. Under this contract, delivery of an 8 processor Cray C-90, replacing the current Cray YMP, is expected to take place in FY93. This increased supercomputer capability will provide the basis for the consolidation of conventional supercomputing into a single facility in FY95. At this time, OA intends to forgo planned upgrades of the Cray YMP supercomputers at both LaRC and LeRC.

4.5. OFFICE OF ADVANCED CONCEPTS AND TECHNOLOGY

The reorganization of the Space Research and Technology Division of the Office of Aeronautics and the Commercial Programs Office into OACT represents a refocusing of NASA's mission and goals relative to space research and commercial programs. Current activities and future proposals for space research are currently being evaluated in the context of their relevance and applicability to commercial development, not solely in regard to their support of and benefit to NASA's space programs.

4.6. OFFICE OF SPACE SCIENCE

The OSS continues to actively participate in the information systems research program initiated in FY92 to apply advanced computer and information systems technology to improve the effectiveness of processing, analysis, transport, archival, and access of space science data.

NASA Science Internet (NSI) enables the unified access to widely distributed information sources in support of the space and earth science community. It currently connects about 4,500 scientists at over 300 research institutions in 15 different countries worldwide.

The OSS is participating in the National Research and Education Network (NREN), an element of the High Performance Computing and Communications initiative. With the initial deployment in March of 1993, the NSI connectivity provided through NREN has enabled the east coast NSI community the use of T3 (45Mbps) rather than the T1 (1.5 Mbps) capability.

National Space Science Data Center (NSSDC) collects, manages, and distributes space science data. To preserve and disseminate data archived at NSSDC over its 27-year lifetime, NSSDC has been migrating aging magnetic tapes to new storage media since 1988. As of April 1993, approximately 26,500 tapes have been migrated, of which 5,900 was accomplished during FY92-FY93.

During FY92-FY93, some significant upgrades have been made to the Hubble Space Telescope (HST) ground system to support the requirements of the HST First Servicing Mission. A multiple Vax 785 based computer systems in the HST Operations Control Center at GSFC were replaced with a Vax 4000 based distributed architecture system to enhance the real-time monitoring and control of the HST spacecraft. The upgrades also included software enhancements to support the new HST spacecraft hardware, Vax memory upgrades, expansion of disk space, and improvements of system networks.

4.7. OFFICE OF MISSION TO PLANET EARTH

In FY93, the MTPE recognized several major accomplishments that resulted from IT investments. The MTPE continued the Scientific and Engineering Workstations Procurement, a Trail Boss program for NASA and other Federal agency use. This procurement was initiated in 1990 with a core of technical, procurement and IRM members, employing a highly unusual strategy and structure for this mass buy. It resulted in nine contracts with consolidated requirements for seven classes of scientific and engineering workstations. These workstations are being used in almost every facet of work and support a wide diversity of programs and experiments in NASA. It is also available for use by other government agencies.

The MTPE instituted an industry/government quality improvement team to meet the challenges of integrating a multivendor, multiterabyte massive data storage system seamlessly into a supercomputing distributed work station environment.

The MTPE also led the NASA/Goddard High Performance Computing and Communications effort with the selection of Grand Challenge investigators, to evaluate parallel processor architectures for solving the Earth and space scientific problems supporting future flight missions. A Cray YMP-EL with the Cray MPP demonstration software was installed along with mass storage testbeds to support the investigators.

The MTPE established the second five-year agreement with a university consortium for the Center for Excellence in Space Data and Information Systems. This agreement brings university computer science capabilities to the Goddard Space and Earth Science researchers. Ten university investigators have been selected to study parallel input/output challenges for High Performance Computing and Communications.

In addition, the MTPE provided an entre into the world of supercomputing and networking for minority universities by leading the Minority University Space Interdisciplinary Network (MUSPIN) efforts. These efforts provide access to and training in state-of-the-art technologies for minority faculty and students. NASA technologies are made available through the Space Data and Computing Division.

The MTPE developed and brought into operation a "hands on" Scientific Visualization Studio Capability. This capability is available to NASA researchers using Space Data and Computing Division systems.

The MTPE created a direct satellite read out station for geostationary satellite images with network links to Offut Air Force Base. The station supported Operation Restore Hope by providing transfer of satellite weather data over Internet. This was a cooperative interagency effort led by SDCD personnel.

The MTPE also upgraded supercomputing by a factor of six, acquiring a six processor Cray C98, to be installed by late FY93, and an interim doubling of the Cray YMP from four processors to eight processors.

4.8. OFFICE OF LIFE AND MICROGRAVITY SCIENCES AND APPLICATIONS

Because the previous Office of Life and Space Sciences, which was responsible for the OLMSA programs during FY 1992, has been divided into three new offices, OLMSA accomplishments are included in Section 4.6. with the Office of Space Science accomplishments.

4.9. OFFICE OF MANAGEMENT SYSTEMS AND FACILITIES

Accomplishments for the STI program, the AIM program, and other IRM functions are provided in the following subsections.

4.9.1 Scientific and Technical Information Program

The NASA STI Program has continued to employ Total Quality Management methods to evaluate and improve the process of acquiring and disseminating STI. The international bilateral and tripartite exchange agreements are under continuous review to ensure that relationships remain beneficial to NASA.

The NASA Access Mechanism (NAM) has completed six months of beta testing at 60 sites within NASA. A "Lessons Learned" document will be completed and published by September 1993 in which recommendations will be made about making the system operational and continuing development.

A prototype for providing a "print on demand" capability for NASA was completed in May 1993. The NASA Selectronic Publishing System project uses NASA networks to send electronic documents to large printers to reproduce multiple copies automatically. The project was completed in conjunction with the Lewis Research Center and the Jet Propulsion Laboratory. An evaluation report was delivered to the Joint Committee on Printing in June 1993. A follow-on project has been initiated at NASA Headquarters.

Analyses of processes employed by the Center for Aerospace Information have continued with a focus on the customer. SCAN, the current awareness mechanism for the NASA community, has been made available electronically using an anonymous File Transfer Protocol server. The network infrastructure has been expanded and enhanced to accommodate electronic communications. A project has been initiated to replace the ancient RECON/STIMS retrieval engine and database management system, which will result in moving the STI Database off the mainframe environment and into a distributed computing environment.

The NASA STI Information Infrastructure Upgrade Plan for modernizing the STI Program over the next five years was approved in February 1993. This plan includes additional network upgrades, full text and image retrieval software, electronic document interchange and dissemination, machine translation, video and multimedia support equipment, additional NASA development, optical imaging, management information software, expert search assistant software, and data manipulation tools.

4.9.2 Automated Information Management Program

Accomplishments for the AIM Program include the implementation of the Consolidated Agency Personnel/Payroll System (CAPPS), which contains personnel and payroll information for all NASA employees and provides any required external reporting. Progress continued on all development projects, including the NASA Accounting and Financial Information System.

As part of the AIM Information Architecture, an Integrated Systems Engineering Environment has been established to provide integrated, automated tool support across all phases of the systems development lifecycle. Specifications for all of the tools have been identified and procurement will occur as funding permits. The initial focus will be on the maintenance phase.

4.9.3 Other IRM Functions

During the past and current fiscal years, NASA has given the management of information resources increased priority. As a result, a number of improvements and accomplishments in IRM have been realized.

IRM Policy

NASA continues to update its IRM policies at the agency level. In the records management activity, a 2-year agencywide records inventory effort, part of the development of the Agency's Records Retention Schedules, was completed. A complete set of these schedules was submitted to the National Archive and Records Administration in December 1992 and a new publication was issued that delineates the Agency's records management policies, procedures, and guidelines. A major revision to NASA's Privacy Act regulation was also completed.

NASA Handbook 1420.21, Index of NASA Prefixed Forms, which provides guidance to all users of the NASA Forms Management Program System, was updated. The handbook documents the alpha-functional index of NASA-prefixed forms by title, identifying number, and unit of issue. A quick reference list of current forms, shown by number and page, is also included for cross-reference.

NASA developed and implemented policies to improve mail management services and increase accountability for and reduce postage costs. Among its elements: (1) conversion to metered mail --$1.2 million cost savings; (2) consolidation of international mail--42% costs savings; (3) implementation of agencywide penalty mail stamp program to accommodate small mailer and employees on travel; and (4) conversion from United States Postal Service Overnight Express to Federal Express--50% cost savings.

IRM Planning and Evaluation

NASA incorporated TQM concepts into its IRM Review Program. An IRM Review Guide was published which will serve as a tool for implementing "self-assessment" at all organizational levels. The Guide documents self-assessment as the primary review process for assuring continual improvement of IRM within NASA. Essential functions are to assess the effectiveness of IRM activities, recognize areas of excellence, identify areas needing improvement, recommend corrective actions, and provide a formal process for prioritizing and implementing those recommendations. The first agencywide self-assessment was completed in 1993.

Information Resources Acquisition Management

During 1993, as part of a continual improvement activity, NASA reduced the in-house processing time for Agency Procurement Requests (APR's) by 264%, with equivalent savings of resources. In the process, NASA improved the quality of its APR's, which in turn reduced the processing time the General Services Administration requires to grant specific acquisition Delegations of Procurement Authority. NASA continued its efforts to consolidate IT requirements for acquisition. Among the many successes, NASA awarded the highly-praised and innovative Personal Computer Acquisition Contract. This indefinite delivery/indefinite quantity contract for personal workstations includes strategies which assure technology upgrade and price competition throughout the term of the contract. NASA also awarded the $800 million SEWP Contract, which provides 9 classes of scientific and engineering workstations for both agencywide and government-wide use.

IT Standards Program

In 1993, NASA took further steps to formalize its IT Standards Program by chartering an agencywide IT Standards Working Group. This group will be the Agency's focal point for coordinating the development and implementation of agencywide IT standards. Presently, work

is underway to establish agencywide standards for E-Mail, digital signatures, and media storage. Also, the Agency's GOSIP Migration Plan was formally implemented.

4.10. OFFICE OF SAFETY AND MISSION ASSURANCE

In October 1992, the OSMA consolidated most IRM activities into the Assurance Information Systems Office in the Safety and Risk Management Division to manage applications development more effectively and efficiently and to ensure the development of integrated systems. The IRM activities that are not within the purview of the Assurance Information Systems Office are the Software Engineering and Assurance function, which remained in the Engineering Division, and IV&V, which will be conducted at the IV&V Center in Fairmont, West Virginia.

Notable accomplishments of the Assurance Information Systems Office were as follows:

- Establishment of a Center of Excellence for Data Systems Development at GSFC. The Center is supporting the OSMA in catching up with the applications backlog that has developed over the past two years. The Center is responsible for the development of a common user interface to facilitate integration of data residing at geographically separate locations and for the development of various applications as specified by users throughout the NASA SRM&QA community. The Center is also responsible for establishing and maintaining an encyclopedia of assurance information systems.

- Development of guidelines for software developers in the use of Information Engineering as a methodology. The guidelines are in draft form at this time and call for the development of data and process models, and the delivery of documentation and the conduct customer reviews during the course of system development. Active management and user participation in the requirements and design phases are called for. The guidelines offer a set of tailored Data Item Descriptions per the NASA Software Engineering Documentation standard, 2100-91.

- Development of a Strategic Information Systems Plan for OSMA. This activity will be initiated late this fiscal year.

Software Engineering and Assurance accomplishments included development of the following standards:

- Software Assurance Standard, NASA STD 2201-93, which was approved in November 1992, and

- Software Formal Inspections Standard, NASA STD 2202-93, which was approved in April 1993.

In addition, Space Shuttle flight Software Readiness assessments for the OSMA Program Assurance Reviews and the Flight Readiness Reviews were conducted in preparation for signing the Certification of Flight Readiness prior to each Shuttle launch.

5. INFORMATION COLLECTION BUDGET

The majority of NASA's public information collection is involved in the procurement function. The NASA Federal Acquisition Regulation Supplement establishes agencywide uniform policies and procedures that implement and supplement the Federal Acquisition Regulation.

NASA will concentrate on two major areas within the procurement function for current and future reductions. One area will center around the continued use of consolidated contracts in order to reduce the solicitation and contract reporting burden on the private sector. The second area will concentrate on reducing reporting requirements associated with contracts awarded under the NASA Procurement Regulation. NASA will continue to emphasize the elimination of any redundant and/or obsolete contract reporting requirements.

Data on NASA's information collection budget are included in an attachment, entitled "NASA Information Collection Budget". These data are provided in response to OMB Bulletin 93-12, Appendix C.

6. SUMMARY OF COMPUTER SECURITY PLANS

6.1. BACKGROUND

NASA formally implemented its Automated Information Security (AIS) Program in 1979. By 1985 a full-time NASA AIS Program Manager position was established. Since then, NASA has conducted many management reviews, extensively refined its AIS policies and procedures, and published over 10 AIS guidelines. Today, AIS is highly integrated throughout NASA in functional management processes using a total systems engineering approach, and through management points-of-contact, intra-agency working groups, councils, and committees. These management and coordinating authorities include senior management IRM and security coordination committees and councils, Program Office AIS Managers, Field Center AIS Managers, local Data Processing Installation AIS Officials, and AIS Coordinators at the application, hardware, and end-user levels.

6.2. IMPROVEMENTS IN THE SECURITY OF NASA SYSTEMS

In FY91, ~ 100 plans for sensitive/critical systems were reviewed to determine the status and quality of AIS implementations. Additional comprehensive follow-up reviews of these systems were conducted in FY92 and FY93. There were many system configuration changes, some deletions, and a few additions. An analysis of over 25 major AIS control categories for these sensitive/critical systems indicated overall important improvements were accomplished at the system level, and major improvements were noticed in AIS reporting accuracy and management understanding of significant AIS issues. NASA is continuing to make significant strides in improving AIS for sensitive/critical systems. New vulnerabilities and risk exposures are continually being identified and monitored through an ongoing program of threat assessment and risk management.

6.3. PERSONNEL COMPUTER SECURITY AWARENESS AND TRAINING PROGRAM

In FY93, NASA continued its integrated and multi-faceted approach (e.g., top-down and bottom-up, internal and external sources) for providing continuous Computer Security Awareness and Training (CSAT) fully realizing that an effective CSAT program must offer more to personnel than just an hour of annual classroom training. NASA has included CSAT sessions in new employee orientations, annual mandatory ethics training, technical learning center training activities, and in training for Contracting Officers, Contracting Officer's Technical Representatives, and Computer/Network Systems Administrators. The topic of AIS is also integrated into many internal management and technical conferences, seminars, workshops, and meetings. CSAT effectiveness was monitored through ongoing internal management and compliance review processes, and it has been evaluated by independent external sources. For example, after a thorough review of NASA's CSAT program in FY92, a National Institute of

Standards and Technology (NIST) report confirmed NASA's solid commitment to assuring continuous, effective, and high quality CSAT.

6.4. NASA-WIDE IMPLEMENTATION ACTIVITIES RESULTING FROM REVIEWS

In February 1991, a management team from the Office of Management and Budget, NIST, and the National Security Agency met with many senior functional program managers to discuss the status of AIS implementation issues. This activity focused additional management attention on AIS within NASA, and reinforced the importance of AIS to the Federal government. As a result, resources were available in FY92/93 to further enhance AIS policies, procedures, tools, and techniques to combat threats associated with rapidly advancing computing and telecommunications technologies. Increased emphasis was placed on integrating AIS requirements into IRM, ADP procurement, and software quality assurance processes; assuring implementation of adequate computer virus scanning capabilities; performing risk assessment and penetration testing for all major sensitive/critical systems; and a high priority was assigned to establishing an agencywide incident response capability.

7. APPENDIX: ACRONYM LIST

ADP	Automated Data Processing
ADPE	Automated Data Processing Equipment
AIM	Automated Information Management
AIS	Automated Information Security
APR	Agency Procurement Requests
ARC	Ames Research Center
AT-EASE	Automated Test Expert Aiding System Environment
CAD	Computer-Aided Design
CAMS	Calibrated Airborne Multispectral Scanner
CAPPS	Consolidated Agency Personnel/Payroll System
CCMS	Checkout Control and Monitor System
CDPA	Control Document Production Area
CDS	Central Data Subsystem
CIN	Center Information Network
CIS	Center Information System
CPU	Central Processing Unit
CSAT	Computer Security Awareness and Training
CTS	Central Telecommunications System
CTSD	Crew and Thermal Systems Division
DASD	Direct Access Storage Device
DCF	Data Capture Facility
DSO	Designated Senior Official
ECF	Engineering Computational Facility
ECS	EOSDIS Core System
EOSDIS	Earth Observing System Data Information System
FADS	Flight Analysis and Design System
FDCF	Flight Design Computational Facility
FIDS	Facility Integration Documentation System
FIP	Federal Information Processing
FIRMR	Federal Information Resources Management Regulations
FPS	Flight Planning System
FTPF	Flight Training and Planning Facility
FTS	Federal Telecommunications System
GSFC	Goddard Space Flight Center
GTDM	Generic Time Division Multiplex

HPCCP	High Performance Computing and Communications Program
HST	Hubble Space Telescope
ILS	Integrated Logistics Support
IMIC	Integrated Management Information Center
IRM	Information Resources Management
IROC	Information Resources Oversight Council
IT	Information Technology
IV&V	Independent Verification and Validation
JIN	Johnson Information Network
JPL	Jet Propulsion Laboratory
JSC	Johnson Space Center
JSCDSS	Johnson Space Center Data Support Systems
KSC	Kennedy Space Center
LAN	Local Area Network
LaRC	Langley Research Center
LeRC	Lewis Research Center
Mbps	Megabits per second
MCC	Mission Control Center
MOD	Mission Operations Directorate
MOSC	Mission Operations Support Contract
MSFC	Marshall Space Flight Center
MTPE	Office of Mission to Planet Earth
MUSPIN	Minority University Space Interdisciplinary Network
MWords	Million words (memory)
NAFIS	NASA Accounting and Financial Information System
NAM	NASA Access Mechanism
NARA	National Archive and Records Administration
NAS	Numerical Aerodynamic Simulation
NASA	National Aeronautics and Space Administration
NIST	National Institute of Standards and Technology
NREN	National Research and Education Network
NSAP	Network Service Assurance Plan
NSI	NASA Science Internet
NSSDC	National Space Science Data Center

OA	Office of Aeronautics
OACT	Office of Advanced Concepts and Technology
OAST	Office of Aeronautics and Space Technology
OLMSA	Office of Life and Microgravity Sciences and Applications
OMB	Office of Management and Budget
OMSF	Office of Management Systems and Facilities
OPERA	OPERation Analyst
OSC	Office of Space Communications
OSF	Office of Space Flight
OSMA	Office of Safety and Mission Assurance
OSS	Office of Space Science
OSSD	Office of Space Systems Development
RMMS	Remote Maintenance Monitoring System
SAIL	Shuttle Avionics Integration Laboratory
SDF	Software Development Facility
SED	Systems Engineering Division
SEWP	Scientific Engineering Workstation Program
SIIO	Senior Installation IRM Official
SIPS	Spacelab Input Processing System
SPF	Software Production Facility
SPIO	Senior Program IRM Official
SR&QA	Safety, Reliability, and Quality Assurance
SRM&QA	Safety, Reliability, Maintainability, and Quality Assurance
SSC	Stennis Space Center
SSE	Software Support Environment
SSEDF	Software Support Environment Development Facility
SSPO	Space Station Program Office
STI	Scientific and Technical Information
STL	Science and Technology Laboratory
STME	Space Transportation Main Engine
TAV	Transatmospheric Research and Technology
TMIS	Technical and Management Information System
TQM	Total Quality Management
TRAM	Tools for Resource Analysis and Management
WAN	Wide Area Network